

VIII. BOTANICAL PHILOSOPHY ON THE SELECTION OF RAIN FOREST RESERVES IN MALESIA

Now that at the Jakarta Forestry Congress it was announced on the behalf of the Indonesian government that a target area has been set to conserve 5% of the land area, eventually to be increased to 10%, the time has come to indicate how these areas are to be allocated. Botanical arguments are available as a guidance; they are drawn from established sources, including experience from work at the Rijksherbarium. A number of points are here given.

1. In Malesia, it is usually possible, clearly to distinguish between primary forest: rich in species, balanced as an ecosystem, complex, fragile, different from place to place, in which rarity of species prevails, slow in regeneration, irreplaceable within any foreseeable amount of time, and secondary forest: poor in species, an ecosystem in succession, simple, aggressive, consisting of common, widespread species, quick in regeneration, and entirely renewable. From the botanical point of view, secondary forest has no conservation value, only primary forest has.

2. Differences in altitude are significant. Rollins & Wyatt-Smith (Mal. Forester 27: 188-216. 1964) analyzed them in Malaya. They found in Lowland Dipterocarp Forest, i.e. below 300 m, 9 different forest types, in the Hill Dipterocarp Forest, 300-750 m, 6 types, in the Upper Hill Dipterocarp Forest, 750-1150 m, 2 types. Foresters in Malaya draw the upper limit of the LDF at 300 m; in the larger islands of Indonesia it may be a bit higher, but 300 m seems safe. Richness in species follows a similar pattern; Richards' Tropical Rainforest, p. 355, cites an example from Mt. Makiling in Luzon, where on 0.25 ha at 450 m, 92 sp. occurred of woody plants taller than 2 m, at 700 m, 70 sp., at 1020 m, 21 sp. (below 450 m, the primary forest had been destroyed).

This evidence leads to the conclusion that richness of rain forests increases towards sea level. From the distinction of zones in the above publication, it follows that if rain forest diversity is to be protected adequately, surface areas must be broken down altitudinally; the areas of these zones must be compared as independent units, and the best representation must be in the lowlands. The differences in richness between the zones amount roughly to a factor 2.

3. Horizontal differences exist everywhere, every square kilometre differing from the next; see point 5. In Malesia, the large islands are richer than the small. For the large islands, in terms of rain forest species, the order is: 1) Borneo, 2) Malaya, 3) New Guinea, 4) Sumatra, 5) Mindanao, 6) Luzon, 7) Celebes, 8) Java. Borneo and Malaya evolved together, and with Sumatra and the Philippines form one unit which accommodates the world's reservoir of Dipterocarps (in Borneo there are 262 species, in Malaya 155, in Sumatra 95, in the Philippines 43). It is interesting to compare in Borneo and New Guinea; the following points then emerge:

Borneo	New Guinea
species estimated at 10,000 endemic genera 135	species estimated at 9,000 endemic genera 150
Dipterocarps: genera 9, species 262	Dipterocarps: genera 3, species 15
climate uniformly wet	climate seasonal in the South, creates another habitat
few high mountains	many high mountains, means different habitats
geologically stable for long times, which enabled evolution of complex, unique ecosystems	geological upheavals promoted evolution of a wide spectrum of less fragile ecosystems
soils usually very poor; peat swamps and kerangas	soils a mosaic
richest centre of Malesian lowland rain forests	richness of species more evenly divided over different altitudes and habitats
easily accessible owing to long geological stability	access difficult owing to steepness

This points to top priority for Borneo in rain forest conservation. As for our indications (based on Dipterocarp distribution): richness is greatest towards the West and towards the North.

4. In view of the differences in richness and composition between islands, each large island should have 5 to 10% of its own land area conserved. Conserving large tracts in Celebes will not save the richness of Kalimantan, for instance.

5. It has been found that the peat swamp forests as well as the kerangas forests have recruited their flora largely from the adjoining dryland forests. This means that conserving these ecosystems makes sense only if the adjoining dryland forests are also conserved.

6. Within an island, there are considerable differences from place to place, especially in the primary forest types. To assess them in detail is difficult and time-consuming; a superficial impression must suffice in many cases. A non-botanist facing the task is advised to pay attention to the comparative abundance of: Compound-leaved families (e.g. Burseraceae, Leguminosae, Meliaceae); Dipterocarpaceae; Ficus in its various life-forms; Fruit trees (relatives of durian, mango, rambutan, and citrus); Guttiferae; Orchids; Palms (climbing and erect); Sapotaceae. Also specialized life-forms like Loranthaceae, parasites and saprophytes are good indicators of diversity. If quick action must be undertaken to base a choice on, a comparison is possible on the basis of these guidelines.

Conservation makes sense only if commercially valuable forests are included in the programs, even with emphasis because of their genetic potential for future forestry.

7. The concept of 'threatened species' is of no use. The abundance is too great for their identification and implementation of restrictions is therefore impossible. Besides, only about half the species of Malesia are satisfactorily known.

8. Gardens are unfit for conservation. The plants are taken out of their ecological context and will not survive without animals. Survival in gardens has been proved to be low even if the plants are artificially maintained. Gardens themselves do mostly not have a long life span. The numbers of rain forest species to be preserved are immense, and procuring them from the forest is difficult and risky.

9. The more species on a hectare, the fewer individuals of one species. Ranges are from 4-5 individuals in one hectare to 1 individual in 20 hectares.

10. Populations must contain and retain a certain amount of genetic diversity, which enables them to respond to (minor, gradual) changes in the environment. A minimum number of individuals is needed for this purpose. Below a minimum number, the diversity spectrum becomes too narrow, and the population is bound eventually to become extinct. A recent calculation (see T.C. Whitmore, A first look at Agathis, p. 45. 1977) estimates the minimum number at ranges between 1000 and 25,000, with 5000 as a fair average. However, many rain forest species (about $\frac{1}{4}$ of the trees) are dioecious, which means that twice the number is needed for biological functioning.

11. From points 9 and 10, it follows that the more species occur on one hectare, the larger a reserve must be to ensure survival. For the rich rain forest, this can be estimated, with Whitmore's calculation as a guidance, at an order of magnitude of hundreds of square kilometres. Small species-rich reserves have no viability; without human disturbance, they will impoverish very gradually, with disturbance, they are invaded by weeds and regeneration will be suffocated.

12. Relations between plants and animals are to be considered. Since the Rafflesia is dispersed by big ungulates who damage the bark of its host wherein the seeds can germinate, its protection requires the protection of the big ungulates. Migration tracks and areas of primates, hornbills, &c. who are in close biological relations to the plants, are to be reckoned with. The outcome may well be a higher minimum area than indicated in point 11.

The function of reserves is to prevent the extinction of species or smaller units of biological diversity. This responsibility is never to be lost sight of. It is the main guidance in our dealings with nature. Never must species (or smaller units of diversity) get lost through human interference. If this point were negotiable, there would be no way to stop the impoverishment of our biological substratum. From this point it also follows, that the onus of proof is on an exploiter, that through his action no taxon becomes endangered. It also follows, that in a reserve — which has been established to save species — no exploitation whatever is permitted for any reason; this would amount to robbing one's own bank.

Does this mean that reserves must not be entered, or utilized at all? What are we eventually to do with the lowland rain forest capital, if men

are wise enough to stop its being squandered for a pittance? I see no end in its potential, but a beginning, yes. As far as 'tapping' is concerned, there is a future for a) chemical substances, b) the gene pool of fruit trees and their relatives, c) the gene pool of dipterocarps and other primary forest timber trees.

To tap this potential without harm to the forest, no tool beyond a parang must be applied. This agreed on, the steps will be: 1) inventory of forest plots, mapping of individual trees, 2) studying phenology and aut-ecology of selected species, 3) collect diaspores, 4) try to grow these outside the conserved forest, in degraded forest, test them, 5) propagate them, distribute plant material.

This is a long-time affair, but it is good, now already to develop clear and feasible ideas on future rain forest management. It must be done on an entirely different basis anyway. In this context especially P.S. Ashton and W. Meijer are worth listening to.

Rijksherbarium, Leiden

M. Jacobs

DIPTEROCARPS: SECOND ROUND TABLE

The International Working Group on Dipterocarpaceae met for the first time in Paris in June 1977; the report on this meeting appeared on *page 3041-3047* in the previous issue. Negotiations are well-advanced to convene a second conference at Kepong, Malaya, in mid-1980, i.e. probably from 27 June to 2 July. This Round Table will be devoted to Ecology and Management, conservation being treated as part of the latter. The idea is, to examine new findings in aut-ecology against silvicultural aspects, to see what new priorities will arise, all with a view on practical, long-term application. Talks are scheduled for 3 days, followed by 3 days of excursions, within Malaya. Papers (all in English) will be welcome, and are to be published after the conference. Accommodation will be simple and cheap: an amount of US\$ 10 a day is envisaged. Anyone interested who has not yet received a circular directly, please contact Dr. M.Jacobs, Rijksherbarium, Box 9514, Leiden, The Netherlands.