more and more elaborate as it gains reiterations.

Having established this basic and novel understanding of the dynamics of tree growth, the authors proceed to consider trees in their environment. There is considerable discussion of the general topic of energetics and a preoccupation with height-diameter ratios and volume-surface relationships, with the emphasis on qualitative rather than quantitative data. It is quite clear, however, that the authors' understanding and interpretation of the forest springs from many hours of thought in the forest rather than in an armchair. Just as the growth of a single tree is seen as a continuous process of developmental adjustment, so is the growth of the forest. Profile and plan diagrams of a number of forest plots are presented at static moments in time, as is conventional, but it is stressed that the forest is a dynamic structure and that the trees within it may be recognized as "trees of the past, trees of the present, and trees of the future" depending upon their status, that is, their future growth potential. The trees of the future constitute a "set" of the future, suppressed by the set of the present (although they may all be the same age), marking time until favorable conditions lead to an increase in growth. The authors maintain that the concept of "succession" oversimplifies the process; any apparent layering that is seen is a passive phenomenon of a transitory nature. The details of individual tree growth presented earlier in the book now begin to make additional sense. We are reminded that as a tree reaches its prime as a tree of the present the accumulating reiterations become progressively smaller; the location of the lowest reiteration usually corresponds to the location of the lowest branch on the tree, this point being designated the morphological inversion point of the tree. This leads to a recognition of the morphological inversion surface within a forest with an influence on microclimate and hence to an ecological inversion surface representing a particular balance of light and humidity.

The book is full of such refreshingly new ways of considering the tree and the forest, and it demands to be read a little at a time, slowly and repeatedly. The shape of a plant is fundamental to its existence, and the understanding of tree shape has itself been a slow process of growth, reiteration, and eventual blossoming.

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A Tropical Flora

Flora of Barro Colorado Island. THOMAS B. CROAT. Stanford University Press, Stanford, Calif., 1978. x, 944 pp., illus. $55.

Western science has developed primarily in the north temperate zone, and the consequences for environmental biology have been profound; many of the earth's richest biomes are the least known. Though travel in the tropics has contributed significantly to the development of biological concepts, intensive long-term studies there have been rare. Until recently, relatively few biologists and very few research centers have been permanently located in species-rich tropical environments. One of the most important of such centers in the American tropics has been Barro Colorado Island, formed when the Panama Canal was built. Research on the island over the last 50 years has contributed significantly to our knowledge of the tropics. An important prerequisite for many kinds of research in an evergreen tropical environment is access to up-to-date information regarding the vascular plants. These plants form much of the community's structure, and they are its primary energy brokers. With the publication of Croat's long-awaited flora we now have the higher plants of this island at our fingertips.

Though only 15.6 square kilometers in area, Barro Colorado Island has by current count 1369 species of higher plants in 704 genera. Each of these species is keyed, described, and discussed in some detail in Croat's flora. The descriptions and keys are supplemented by over 550 of the author's photographs. The keys are well constructed and should offer no problems to someone with minimal botanical training, and there is a unique bonus. Near the end of the book are 47 pages devoted to a key to woody plants lacking both flowers and fruit. This key covers about 700 species and, considering how infrequently some woody plants produce flowers and fruit, should be one of the most useful parts of the book. At least one copy of the book has already been taken to Colombia for use in identifying lowland rain forest trees there. Small areas in lowland Colombia and Barro Colorado Island probably share more than 70 percent of their woody genera, enough for the key to those plants to be of considerable help. In fact, the keys should be useful over a wide area of lowland evergreen middle America.

The flora makes available much new information based largely on field observation. The 60-page introduction, which includes considerable information on flowering and fruiting phenology both for individual species and for the assemblage as a whole, will be useful in planning research projects and selecting species for study. Confusion of closely similar species and separation of "species" that are only parts of a single polymorphic population have been especially serious problems in the species-rich tropics. This book will help avoid these pitfalls and give both community ecologists and biologists working with specific taxa a better foundation on which to begin. A good bibliography, maps, and data on pollination and dispersal round out the volume.

Elaeis oleifera. [From *Flora of Barro Colorado Island*]

The book is massive, weighing a hefty 2.6 kilograms, but is a bargain in today's world of inflated prices. Stanford University Press has given it its due; it is well designed and the typography is exceptionally clear.

Interestingly, the volume was published in the same year as two other well-illustrated floras covering small areas in the American tropics: C. H. Dodson and A. H. Gentry's "Flora of the Rio Palenque Science Center, Los Rios, Ecuador," *Selbyana* **4**, 1-628 (1978), and J. A. Steyermark and O. Huber's *Flora del Avila* (Ministerio del Ambiente y de los Recursos Naturales Renovables, Caracas, Venezuela, 1978). Together, these works can serve as stepping-stones into the world's richest floristic region while more comprehensive, large-scale floras are being prepared.

Recent international agreements and increased use by Panamanian students make one hopeful that Barro Colorado Island will continue to support research for decades to come. With Croat's impressive flora to add to the host of earlier work, current and future researchers should find this little island especially hospitable for more refined and intensive work in a very diverse tropical forest ecosystem.

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Heterogeneity and Evolution

Marine Organisms. Genetics, Ecology, and Evolution. Proceedings of a conference, Venice, March 1977. BRUNO BATTAGLIA and JOHN A. BEARDMORE, Eds. Plenum, New York, 1978. x, 758 pp., illus. $49.50. NATO Conference Series IV, vol. 2.

Assuming the central dogma of molecular biology (DNA→RNA→protein) and utilizing the methods of protein electrophoresis, geneticists in 1966 identified for the first time not only polymorphic but also monomorphic loci. This identification made possible the estimation of genetic variability. Although exceptions have been reported, the initial estimates of approximately 5 to 15 percent heterozygosity calculated for humans and flies have proved to be generally predictive of the vast amount of variability present in most populations. The discovery of this store of electrophoretically detectable variability sparked the neutralist-selectionist debate over the biological significance of this allozymic variation. The selectionist school argued that the allozyme variants were balanced polymorphisms maintained by natural selection. Neutralists, on the other hand, explained the same data sets by arguing that selection was unable to perceive the differences between most allozymes and that they were present in natural populations owing to the interplay of recurrent mutation and effective population size. Most of the allozyme studies or surveys published in the years just following the initial reports attempted to resolve the controversy by showing generalized agreement or disagreement with predictions of the neutral model. The accuracy of mutation and population size parameter estimates was not such as to permit resolution of the debate, and apparent victories were quickly and predictably nullified by counterarguments or interpretations. Fortunately the heat of the debate attracted a great deal of attention, and many of those attracted brought with them old questions to which the techniques of gel electrophoresis could be applied. This has increased intellectual cross-fertilization among geneticists, ecologists, taxonomists, physiologists, and developmental biologists. The techniques were soon employed in studies of spatial and temporal patterns of variability and in quantifying genetic divergence between different taxonomic levels. Electrophoretic identification of protein variants was, quite clearly, a technique of great utility for ecology and evolutionary systematics as well as for genetics. It not only permitted identification of monomorphic loci, it allowed quasi-genetic study of organisms that could not be cultured in the laboratory.

By 1970 a number of marine biologists had begun electrophoretic studies and others had begun to apply these techniques to marine organisms. This book contains the proceedings of a NATO Advanced Research Institute organized to bring together a sample of those working on the genetics, ecology, and evolution of marine organisms. The majority of the 33 papers deal, in one way or another, with electrophoretic studies; the remaining papers provide interesting parallel approaches to questions addressed electrophoretically by other contributors. The papers are grouped into five sections: measurement and maintenance of genetic variation, ecology and life history, taxonomy, sex determination and breeding systems, and applied genetics. The grouping is somewhat arbitrary, and the reader interested in only one topic will have to use the index to guide the section-jumping necessary to obtain an appreciation of the cross-fertilization of ideas and questions contained in the volume.

One topic addressed by many of the contributors is the rather obvious, if somewhat difficult to delineate, prediction of ecological genetics that genetic variability should be related to physical or biotic environmental heterogeneity. Assuming that allozyme variation is subject to natural selection, estimation of genetic variability in organisms occupying different environments permits testing of these correlational hypotheses. A variety of hypotheses have been proposed in an attempt to predict correlation of environmental and genetic heterogeneity. One, proposed by Bretsky and Lorenz in 1969, was that extinction patterns in the fossil record could be explained on the basis of a positive correlation between genetic variability and environmental stability. That is, organisms in stable environments are expected to have less variable gene pools, owing to specialized adaptation; as a consequence they are unable to adapt to major environmental changes, and extinction rates are expected to be higher for such organisms. Studies of the giant clam *Tridacna maxima* and deep-sea asteroids by Ayala, Valentine, and Hedgecock uncovered unexpectedly high amounts of genetic variability. Since these organisms had been selected for study because they lived in stable environments, an explanation of their high variability was required. According to the trophic-resource-stability hypothesis of Ayala and Valentine, organisms in temporally stable environments are able to perceive their spatial environment as coarse-grained. The luxury of trophic stability permits them to adapt genetically to the coarse grain. Ayala and Valentine's evidence, discussed by them in two contributions, is consistent with this hypothesis. The estimates Ward and Galleguillos present of average heterozygosity in three temperate-zone teleosts are at variance with the prediction of the trophic-resource-stability hypothesis if class averages for heterozygosity estimates are admissible. Fish exhibit heterozygosities in the vertebrate range of approximately 0.05; plaice, dab, and flounder, studied