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The Hunt Institute for Botanical Documentation, a research division of Carnegie Mellon University, specializes in the history of botany and all aspects of plant science and serves the international scientific community through research and documentation. To this end, the Institute acquires and maintains authoritative collections of books, plant images, manuscripts, portraits and data files, and provides publications and other modes of information service. The Institute meets the reference needs of botanists, biologists, historians, conservationists, librarians, bibliographers and the public at large, especially those concerned with any aspect of the North American flora.

Hunt Institute was dedicated in 1961 as the Rachel McMasters Miller Hunt Botanical Library, an international center for bibliographical research and service in the interests of botany and horticulture, as well as a center for the study of all aspects of the history of the plant sciences. By 1971 the Library's activities had so diversified that the name was changed to Hunt Institute for Botanical Documentation. Growth in collections and research projects led to the establishment of four programmatic departments: Archives, Art, Bibliography and the Library.

INSTITUTO INTERAMERICANO DE CIENCIAS AGRICOLAS DE LA OEA

El Instituto es un organismo especializado de la Organización de los Estados Americanos. Fue establecido por los Gobiernos de las Repúblicas Americanas en 1944 para promover su desarrollo económico y social a través de la educación y la investigación.

DIRECCION GENERAL
APARTADO 4359
SAN JOSE, COSTA RICA
CABLE: AGROEA - SAN JOSE

November 12, 1964 P 386

Dr. David J. Rogers
Curator of Economic Botany
The New York Botanical Garden
Bronx Park
New York 58, N. Y.
U. S. A.

Dear Mr. Rogers:

Since the publication of SYMPOSIA INTERAMERICANA has been discontinued and there are few possibilities of issuance in the future, I am, therefore, returning your manuscript, Studies of Tropical Forest Utilization, for publication somewhere else.

Yours very truly,

Isabel Olaso

Isabel Olaso
Secretary to Dr. Marull

io.

Encl.

El Instituto tiene su Dirección General en Costa Rica: Apartado 4359, San José. Sus tres Oficinas Regionales abarcan los siguientes países: Zona Andina, Apartado 478, Lima, Perú (Bolivia, Colombia, Ecuador, Perú y Venezuela); Zona Norte, Apartado 4359, San José, Costa Rica (México, Istmo Centroamericano y Antillas Mayores); Zona Sur, Casilla de Correos 1217, Montevideo, Uruguay (Argentina, Brasil, Chile, Paraguay y Uruguay). Mantiene dos centros: Centro Tropical de Investigación y Enseñanza para Graduados, Turrialba, Costa Rica; y Centro de Investigación y Enseñanza para la Zona Templada como parte del Centro de Investigaciones Agrícolas del Uruguay, La Estanzuela, Colonia, Uruguay. Administra los Proyectos 39 (Enseñanza Técnica Profesional) 201 (Crédito Agrícola), y 206 (Reforma Agraria) del Programa de Cooperación Técnica de la OEA, patrocinados por el Consejo Interamericano Económico y Social (CIES). Mantiene también núcleos de investigación y enseñanza para graduados en instituciones de los países miembros.

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STUDIES OF TROPICAL FOREST UTILIZATION [1]

David J. Rogers [2]

One of man's last great frontiers is the tropical rain forest. In some parts of the world, it is no longer a frontier, but is being exploited--ruthlessly in many cases, wisely in a few (ex. of poor usage--slash and burn, indiscriminate timber cutting). The Malaysian rubber plantations seem to be good use of areas originally covered by forest trees, for Hevea brasiliensis is also a forest tree. Cacao grows well in humid tropical lowlands and simulates to some extent the original conditions. But these two really occupy only fringes of the major tropical forest areas and are kept going only by the pressing demands of highly industrialized countries. Millions of dollars, pounds, francs, pesos, cruzeiros, etc. have been spent on these plants. What do we know of the other plants of these forests?

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1. Ideas for this paper grew from casual observations of forest utilization in several areas of the American tropics and from a fruitful conversation with Dr. Armando Samper. I am grateful for suggestions made by Dr. Bruce Lamb, Dr. Pierre Dansereau and many other scientists.

2. Curator of Economic Botany, The New York Botanical Garden, Bronx Park, New York 58, New York.

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Population growth over the next 50-100 years will demand more space--more lebensraum. The people in whose countries these tropical forests lie will be forced to make farther and farther inroads into the now uninhabited or sparsely inhabited tropical rainforests. The knowledge available beforehand on the proper use of these areas will determine whether these people will find peace and prosperity or degrading poverty. What do we know of the proper use of these lands?

It seems obvious that we cannot impose a temperate-type of farming or forestry operation upon the tropical forest. More people now recognize this than before. One of the best approaches to the development of this area is that of Holdridge, who attacks the problem from the basic ecological point of view. His studies would seem to be of such basic value that many efforts should be started to test his suggestions.

I have tried to imagine how the first Indian groups to populate various parts of the Central and South American forests approached their problems of food and shelter supply. How did they learn to live with this environment? How did they choose their food supply? All by trial and error? Perhaps, but those who know the Indians best know also that the various tribes were (and still are) exceedingly observant botanists, and one might assume from this that they knew what might be expected from certain types of plants. Perhaps they have already surveyed the possibilities, at least from their

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own background of knowledge and requirements, and we should make every effort to put down some record of their present knowledge. Then we may build upon that knowledge for modern-day requirements.

We should, as scientists, re-examine our approaches and present directions in studies of utilization of the tropical rain forest. We know some of the useful plants, but do we know all of them? I think that there should be some possibilities of using the huge forest trees of the family Leguminosae in other ways than for lumber and allied products. There are some tree species of legumes already in use as food. Ceratonia siliqua (Carob, St. John's bread) and various species of Inga are employed for food from their fruiting structures. Are there no others? The seed productivity of some of the rain forest legumes must be very high. Perhaps some conversion by modern processing techniques will be required to make the material more attractive as food. Perhaps Gilbertiodendron (Pithecolobium) dewavrei which grows in almost pure stands in the African rain forest (Congo) should be examined as a possibility in this setting. Pirie 3/ has demonstrated the practicality of extracting biologically active leaf protein in an inexpensive process, and perhaps other biological engineering processes are available. The legumes are not alone as possible sources of proteins, fats, and oils. Already the Brazil nut

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3. Discovery, pp. 374-379. Sept., 1960.

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(from several species of Lecythidaceae) are harvested from the wild. So too are the peach palm (Guillerma [Bactris] gassipes), the African oil palm (Elaeis guineensis), the cohune palm (Orbignya cohune), and to a limited extent the seeds of various species of Hevea.

There is no dearth of carbohydrate-yielding tropical rain forest plants. Yuca (M. esculenta) is already well adapted, in countless varieties, to almost any habitat and soil of the rainforest. Bananas and plantains are also available. But the need for diversification of the diet, using plants with many different components is imperative. It is unlikely that man with his basic metabolic mechanisms well adapted for use of animal and plant products will ever be converted to a purely vegetarian diet. How can he efficiently use the tropical rain forest for forage areas necessary to feed livestock? I doubt that he can expect to produce satisfactory quantities of cattle in these areas to provide his total needs although some forest trees, Brosimum alicastrum, for example, provide excellent fodder and edible seeds. Either he concentrates on water buffalo, pigs, and chickens, or he must import from savannah lands the required animal products.

Most of the rain forests are bordered by savannah or park-like lands. These are, in the case of Brazil, not particularly attractive as agricultural lands. The "cerrado" of Brazil is open because of low fertility (carrying capacity)

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of the soils. The cerrado is not comparable to the prairie of central North American continent, whose soils are very deep and very rich. These lands should, however, be studied intensively for the possible introduction of suitable forage crops. A comparison here is useful. Not many years ago, the areas in Florida called pineland (high and low) were not particularly valuable as cattle country. The "soil" was very low in mineral nutrients, composed mostly of deep sand. Organic matter content was low and quickly lost in plowed land. Yet a combined study of soil needs, plus an intensive search for suitable forage grasses, legumes, etc., fire control and conservation practices have very dramatically changed Florida from a former importer of beef and milk to one of the United States' greatest producers of these important commodities. Incidentally one of the best forage grasses (Bahia) for Florida seems to have originated in Brazil.

I do not say that the same approach will work for all other areas. But the primary importance is the necessary integrated research, studying all aspects of the problem of soil productivity and human needs.

Returning once again to the rain forest, there are other needs for a successful utilization of the areas than just food and forage. There is no doubt that the whole economy of such areas must rest upon production of plant materials and products. Forestry studies must examine more than production of lumber,

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veneer, plywood, paper and construction materials. From the forests must also come oils, waxes, varnishes, condiments, distillation and fermentation products, medicines, and other human needs. Sweden's use of forest products in World War II provide a useful background.

Perhaps one of the biggest problems involved in tropical forest utilization is the method of harvesting the various products. Where huge areas may be devoted to the production of a single species, little difficulty is found in gathering. However, it is clear that a monoculture in tropical rain forests is not practical. How then are we to approach this very difficult problem? No easy solution is possible, but I again suggest that Holdridge's recommendation for forest utilization be examined in detail, with a few modifications. One might envisage several types of eco-communities, some devoted largely to food production, others devoted to commercial production. If such activities could be coordinated, one might eventually assume some sort of balanced productivity.

A diagram (Figure 1) here is more useful than explanation. A community center would act as the storage point and distribution point for the varied products of each producing center. It would also act as a connection with other points, having transport facilities (water, road, rail, air).

The primary centers are the "farming" areas. They contain the mixed groups of cultivars selected to fit the same ecological stories that originally occurred in the native

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condition before cultivation. The species used are selected to avoid competition between the stories, and to give maximum protection to the soil. Thus, on the lower levels or stories are raised root crops, or perhaps some grass crop, or herbaceous lianas (cucurbits, etc.), with an over head of cacao, or African oil palm, or other wide-spaced species, and these in turn are under the higher story, the forest canopy of leguminous trees, or any particularly valuable commercial species. The actual selection of species to be used would depend upon considerable research and practical experience. Much could be determined, however, by observations of Indian cultures that have not been converted to temperate type agriculture.

The rotation of the primary centers would be on a long-term basis, the term actually fixed by the demands of the tallest species. Whether the rotation should move the primary centers into the forested buffer zones between centers, or into the cleared adjacent primary center is again a problem for experimentation.

This idealized diagram presupposes a considerable amount of preliminary investigation. One would certainly begin by aerial photographs of an area, determining the physical features of the land--drainage patterns, major geological formations, forest types, and other factors which would be used in actual determination of the positioning of each of the primary centers. There would have to be considerable socio-economic

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investigation in advance. Certainly the major consideration would be the availability and willingness of certain people to live and work in such a complex. The financial backing for the establishment of such a center would have to be worked out in minute detail in advance. Long-term loans would be requisite to allow amortization of financial obligations on an equitable basis. Indeed, the first of such an endeavor should be considered as experimental, without anticipation of financial return, and would therefore have to be carried by large governmental and private grants.

The original plans for such a new center would certainly have to have consideration of short-term cash crops, along with the longer term permanent types of planting. Perhaps the "Taungya" forestry system used in India and other Asian countries would serve as a model for this planning. In this system, the forest land is leased to the cultivator rent free for two or more years in return for labor and care of forest tree planting. The cultivator clears the land, shares in the profits of the sale of the cleared timber, burns and clears the area under lease, plants his cash or food crops, and simultaneously cares for the forest tree planting. Some of the disadvantages of the "taungya" system, as mentioned by Kadami ("Methods of increasing growth and obtaining regeneration of tropical forests," in Tropical Silviculture, pp. 73-75, Vol. II. FAO, Rome, 1957) could be overcome with careful planning of the integrated endeavor.

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The only difference in this plan and the actual arrangements today is that no one of the primary centers can produce enough to be entirely self-sufficient, so must depend upon its neighbors. Thus the community center collects and stores products of each until such time as is convenient for exchanging either goods or money. Recall that these centers are primarily for farming activities and for industrial purposes secondarily. Industrial centers, trading communities, etc. would eventually be interconnected, as is the case in all organized cities, states, and nations.

The primary needs of such organization are the integrated research on plants of potential value; the use and control of fire; soil conditions for varied productivity; anthropological studies of the people, past, present, and future; and economic requirements of each item above. No other method can achieve the goals of a satisfactory life and use of the huge, and basically productive, tropical forests.

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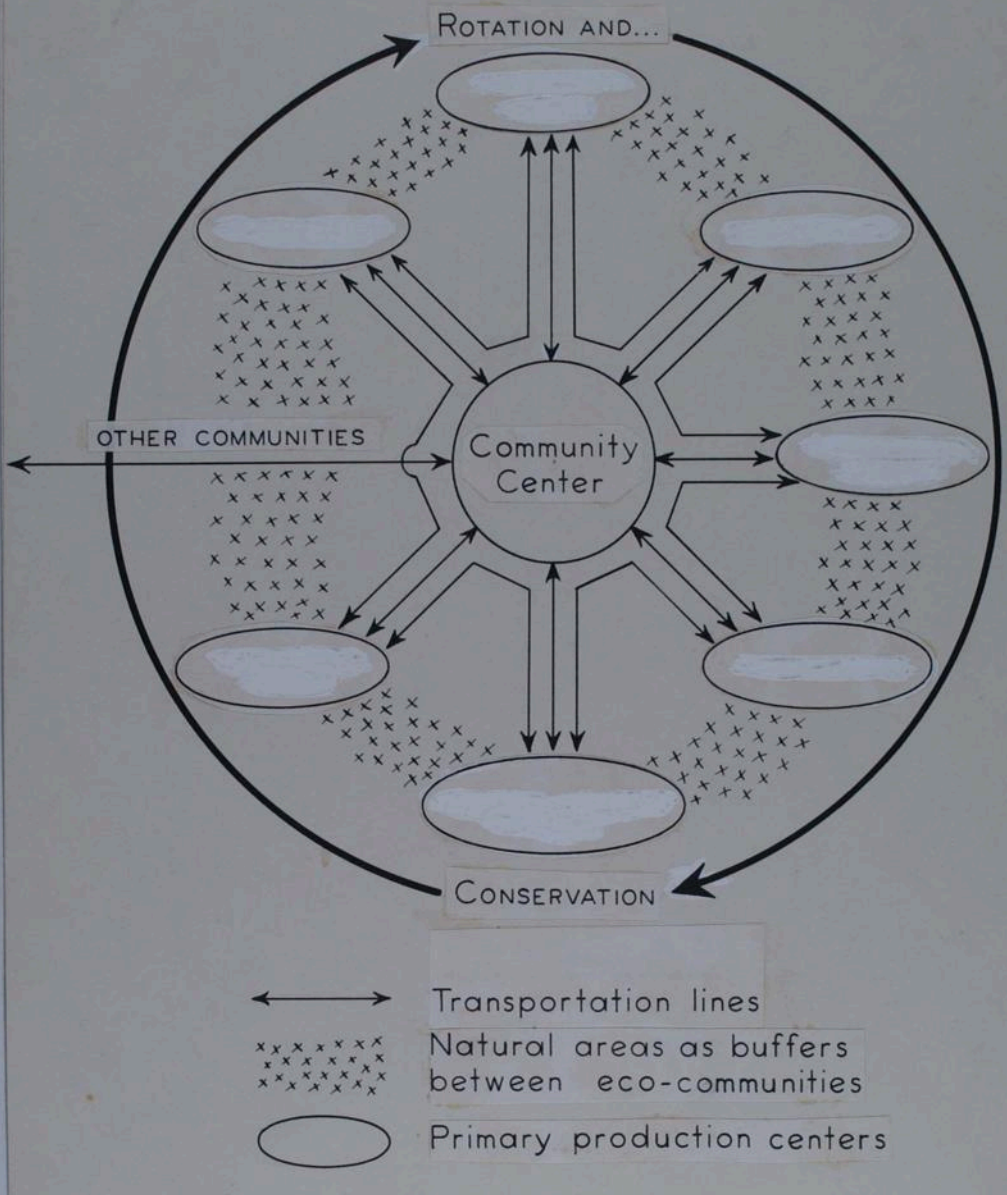

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