

Initial Site Studies for the International Program in the Tropical and Far Western Pacific

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Memorandum on IBP Sites

The International Biological Program (=IBP) is embarking on comparative studies of the nature and functions of the major ecosystems in the world. The United States has formed a National Committee operating in the National Academy of Sciences to coordinate funding of participation of its citizens in the IBP.

Selecting and completing the initial studies on a complement of study sites and facilities in the tropics similar to those in the temperate zone is our concern previous to seeking funding for the actual research to be carried out.

It is fairly well accepted that temperate biota are merely attenuations of tropical ones that have developed away from the tropical optimum. Thus the tropical study sites and the studies themselves must be comprehensive enough and sufficiently adequate to provide also for a fuller understanding of temperate zone ecosystems. Likewise the studies and sites must be as closely comparable as possible for information gathered in one is to be interpreted in comparison to that gathered in other areas. It is expected that through big or poly-national groups or individuals cooperating these features so necessary to the success of any IBP can be achieved.

The scientific objectives of a matching concentration of ecosystem studies in the tropics surely need little justification. However, the sites selected for intensive and continuing studies must be protected from undue human influences that tend to alter them. Such permanently safeguarded sites in addition to serving as permanent laboratories for future fundamental natural science work will serve the following three main applied scientific purposes:

1. To study the processes that take place under natural conditions within such ecosystems for a better understanding to help future resource management.
2. To preserve their natural floras and faunas as gene pools for future use coming about through technological advances, and as breeding stock for producing the new gene combinations required in the future.

NOTE: This is in essence an assemblage of ideas to be incorporated, rejected, augmented or built upon in producing a draft proposal to be circulated to the cooperators who have suggested these different sites or an interest in working in them.

3. To use these as controls in the study of areas now under management.

Beyond the scientific need to understand the world we live in, people as a matter of academic interest have a need for more and better knowledge and familiarity with the tropical environment. Major campaigns of two wars (World War II and the current Viet Nam conflict) have taken place in the tropics and are still going on. Resort must be had to expensive and wasteful "crash programs" to gain the information needed to pursue these campaigns effectively, because of previous neglect of these tropical parts of the world by scientists.

Some nations are spending billions of dollars a year in foreign aid programs, largely to help countries which lie in tropical regions. Much of this money is being spent on projects involving the environment, either aimed at ameliorating it or at exploiting and utilizing it. It should not take great acuity to realise that much of this expenditure will likely be wasted, if not, indeed, be deleterious to the countries involved, if carried on with inadequate understanding of the environments concerned. Therefore, it seems not unwise to direct as much effort as we are able toward long term investigations of the tropics such as those planned under the IBP.

The University of Hawaii and the Smithsonian Institution have extensive contacts and cooperative relationships with scientific institutions and individuals in various tropical countries. Many of these have expressed interest in and desire to participate in activities related to the IBP, but rather few tropical countries have, at present, viable IBP national committees. Such might emerge in the future if tangible activities and training opportunities in the IBP framework were initiated. It seems within the capacity of the two U. S. institutions to bring this about. It is proposed to do this in such tropical countries as offer effective local cooperation and desire to participate.

Specific Objectives

We envisage a series of tropical IBP study sites extending from tropical America across Hawaii into the Old World Tropics, including South Asia to Africa. For our purposes, the north-south extent of this tropical belt can be seen as limited approximately by the Latitudes 20°N and 20° S (Fig. 1). Selected comparative ecological profiles throughout this geographic belt will serve for the elucidation of such important scientific and practical questions as:

1. The origin and adaptation of the peoples in the Pacific Basin.
2. The origin and evolution of the faunas and floras of tropical regions.
3. The origin and selection of the principal economic species and their ecological tolerances and adaptability.
4. The origin, development and homeostatic mechanisms of the major ecosystems in different climatic and edaphic situations in the tropics.
5. The comparative utilization of environmental resources of the principal tropical ecosystems by their biotic communities in different biotic provinces.
6. The comparative utilization of the environmental resources of recent volcanic and ancient physiographic environments by their biotic communities.

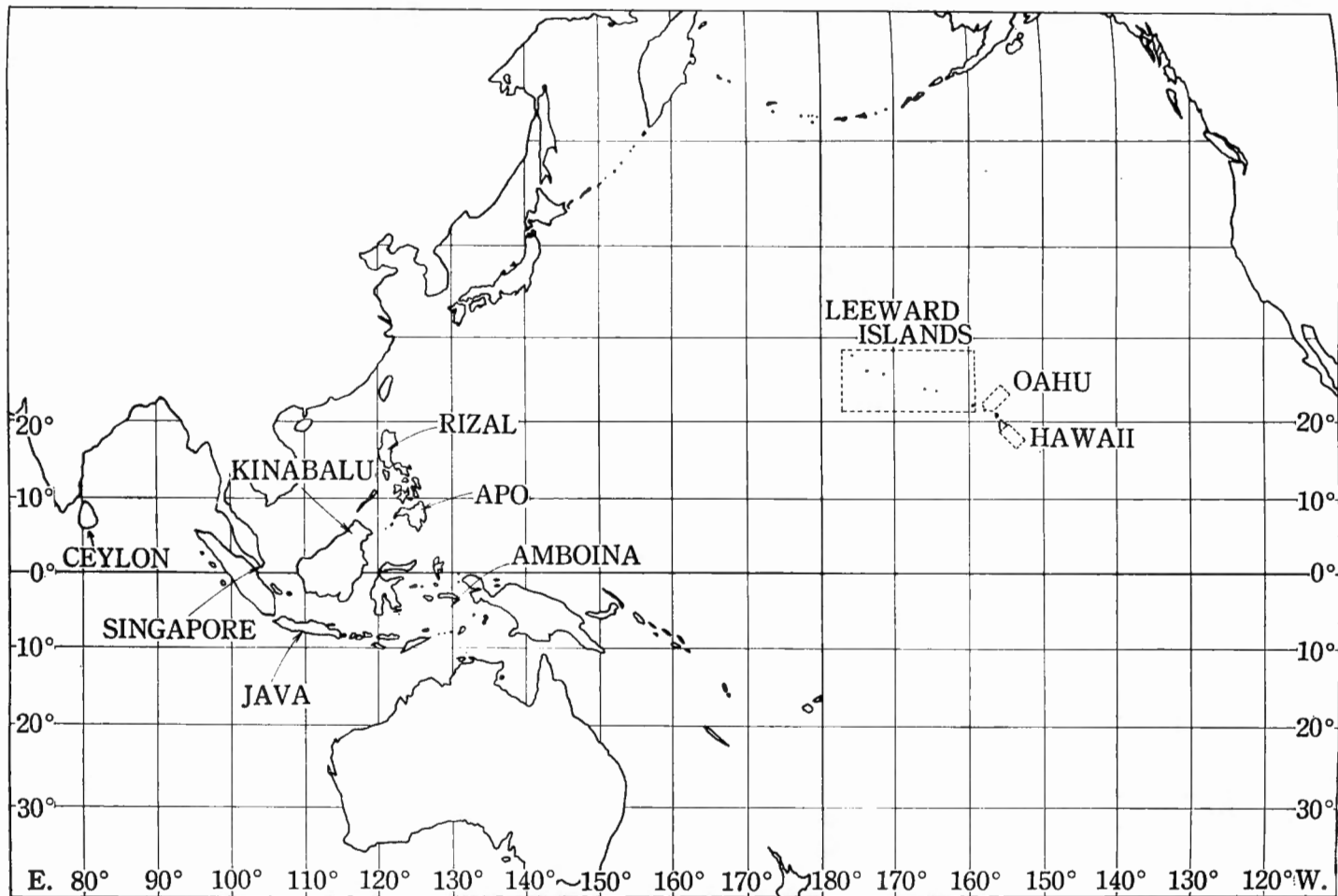


Fig. 1. The location of the Old World Tropics and related American areas among which might be selected a series of sites proposed for the IBP cooperative program envisaged.

7. The comparative net productivity of organic matter and energy and the comparative productive processes operative in different biotic provinces, climatic regimes and edaphic situations.
8. The comparative suitability of the different tropical ecosystems as human habitats.
9. The approaches to conservation of these ecosystems, both as wholes and as particular components especially important to man.

Both the Smithsonian Institution and the University of Hawaii have, of long standing, considerable capability in the essential fields of tropical biology. Staff members of both institutions would be involved, those of the Smithsonian probably largely with the tropical American sites, those of the University of Hawaii very largely to the south and west in the Indo-Pacific region, but actually wherever the interests and capacities of the individuals were most appropriate. Additional staff would necessarily be employed to concentrate more fully on critical aspects of the development and study of these sites. However, as large a share of all aspects of both development and subsequent study of the areas as they could handle would be assigned to the mature and developing scientists of the countries in which the sites were located. The training aspects of this side of the program should be of enormous importance to the development of natural science in these countries.

Proposed Plan of Action

Based on their present understanding of the before-mentioned tropical belt, the University of Hawaii and the Smithsonian Institution propose selection of a series of IBP sites along the following guide lines:

1. The availability of the site for IBP purposes.
2. Positive interest on the part of the host country and host agencies in having this site used as an IBP study area.
3. Assurance of protection or preservation of the site for the purposes of the IBP.
4. The availability of aerial photography for the area.
5. The availability of other information such as weather observations, soil studies, and some knowledge of the biota at least through the taxonomic phase.
6. Ready accessibility from outside of the country and from the cooperating institutions or scientific centers within the country.
7. Such things of primary importance as the waiving of customs and immigration barriers to moving scientific material and personnel in and out of the site or country.
8. The amount of effort that the host country or institutions will commit to the particular programs.
9. Comparability of the sites topographically and in relation to weather and both primitive and secondary (disturbed) areas in a gamut of climates; availability of fresh water and terrestrial habitats at different elevations,

as well as marine habitats and the open sea.

Sites such as the following could be considered in Hawaii for such studies:

1. Hawaii Volcanoes National Park, which is already under study on the island of Hawaii (Fig. 1). There is complete photo coverage in conventional black and white quality photos for mapping (U.S. Geological Survey) and, in part, infrared photography, as well as a considerable amount of other technical information. The site is protected as a National Park and available by the expressed wish of the National Park Service for continued biological study. This is the primary site in the western United States for this group.

The results of the initial study of this site have been assembled in an atlas. The information available to date on this site and which is information any biologist would need in undertaking an ecological or other IBP study has been included. Often this is in tables or lists.

Actually the atlas is a 510-page book with, in addition, 53 sets of 27-by 27-inch figures. Each set of these large figures consists of an aerial photograph of mapping quality at a scale of about 4 inches to the mile and on which even individual large bushes can be distinguished. Each set also includes a topographic and political transparent overlay and a second transparent overlay, which is a vegetation map. There are 34 figures in the text. Many of these are climate diagrams, vegetation profiles, soil profiles, geological sections or displays of weather information. There are also index maps to the sets of overlays, to the available aerial photographs and maps along with directions for obtaining same. An abstract of the Table of Contents follows in simplified form:

<i>Chapter</i>	<i>Pages</i>
Introduction	1-6
Geography, Maps & Aerial Photography	7-21
Geology	22-39
Weather	40-84
Climate	85-92
Soils	93-142
Flora & Fauna of the Area	143-272
Vegetation Descriptions	274-390
Vegetation Map & Vegetation Profiles	391-441
Bibliography	442-470
Index to the text and to the organisms known from the area	471-507

2. Crest of the Koolau Mountains on the island of Oahu (Fig. 1) to the offshore waters beyond Kaneohe Bay. This is a site of intense interest to the State of Hawaii and several federal agencies for it is receiving ever increasingly strong pressure from the burgeoning human population. Scientifically it is important as an area in which many unique species grow

- and in which occur a good many diverse and interesting habitats. There is much scattered information available for this site including aerial photographs, but it has never been assembled. There is an unusual amount of interinstitutional, inter-University-departmental and other activity and interest in this site. This is not a protected site except for loose protection of the small islands as wildlife preserves and the water reserve status and physical inaccessibility of some of the mountain areas.
3. The leeward islands of the Hawaiian chain (Fig. 1). There is a great deal of scattered information available on this site, but it has never been assembled. It is believed aerial photographs are available or that the military authorities would make them available. Part of this site is protected in being a federal wildlife refuge but only loosely protected. Unless the Na Pali coast of Kauai were to be included and perhaps Waialeale, no high islands of note (La Perouse rocks and Nihoa and Necker Islands hardly qualify) are included. This site provides an unusual opportunity to study biogeographic phenomena and previously unstudied ecological phenomena. These have been highly altered by man insofar as the terrestrial communities are concerned, but the marine areas are hardly touched. Transects and study plots have been laid out on some of the islands and studied over a period of years already. The bird population through the federal and state agencies have been receiving almost constant attention. The Pacific Biological Survey Project of the Smithsonian Institution, on which project the Botany Department of the University of Hawaii has been a regular collaborator, has done intensive work here. The mammals have received special attention from time to time. An extensive bibliography on these islands has been prepared by the U.S. Fish and Wildlife Service. Use of this site would probably require support for a ship for over one year in order that one complete year of observation could be obtained. Military and Coast Guard installations would provide valuable observation posts and ensure logistics to a certain degree.

To match these sites, the University of Hawaii and the Smithsonian Institution are anxious to see initiated and carried out studies of comparable sites in a series extending into the Old World Tropics of the Far Western Pacific and Southeast Asia, as well as in tropical America and Africa. It is hoped that through adequate planning sufficiently far in advance, accompanied by uniform training of the observers, a uniform set of observations and experiments can be made at each of the selected sites. In order to select the sites, a large number of potentially useful sites which have been suggested by various people must be screened and from them a few selected for the likelihood of the ends of the project being achieved. However, it is hoped that this may be a flexible, open-ended program and that additional sites may be included as needed and as opportunities arise and personnel become available for their development and study.

It is now proposed that the Smithsonian Institution and the University of Hawaii

cooperate in preliminary site surveys to select sites for the cooperative IBP activities.

This is a portion of a phased program which is expected to have the following elements:

1. Preliminary survey of sites.

Preliminary resume of proposed sites, their characteristics and suitability for the IBP work on an internationally cooperative basis, and determination of local interest in developing them.

2. Development of sites:

Preparation of preliminary atlases of the currently available information for those few sites selected for further study and IBP use. One such atlas has been completed (see above), that for Hawaii Volcanoes National Park.

Collection of essential additional information.

Preparation of handbooks of the basic climatic, edaphic, biotic, and technical information needed for the IBP investigations on these sites.

Training of observers from participating organizations to carry out standard observations.

3. IBP studies:

Implementation and carrying out of standard as well as individual research programs at the different sites.

Symposium meetings of the scientific personnel who have completed internationally standard programs on the individual sites.

Synthesis and publication of the results of the individual site studies and the reduced synthesized results of the whole study along with recommendations for future study, management and conservation of the areas.

During various meetings of IBP groups and at the different recent international congresses and national meetings, as well as in private conversations, the following sites have been suggested. The locations of some of these are shown on Figure 1, *et seq.* Each site should be described briefly here with an accompanying more detailed map than Figure 1 showing its location and other features. However, the present list is of suggested sites only, and their suggestion has usually only been from the U.S. scientific people. We propose to collect site suggestions from the proper agencies and individual scientists in the respective countries and refine this list to one of many fewer sites. When that is done, site descriptions probably shorter than the example of Ujung Kulon, below, and of standardized form and content can be prepared, each accompanied at least by a map, and be located on a map such as Figure 1. The following is the current list of sites:

A. Ceylon

1. Nuwara Elia and Horton Plain
2. Galle marine site and rain forest site near by
3. Ruhuna National Park and Wilpattu National Park

B. Indonesia (Figure 2)

1. Amboina
2. _____
3. Mts. Gedeh-Pangaranga-Tjibodas
4. Ujung Kulon

(As an example, a brief description of this last site above is included at this point before continuing the list.)

(Figs. 2 & 3)

This site is essentially the westernmost tip of Java, a peninsula about 15 miles long and of irregular shape, being about 10 miles wide at the widest. At the eastern end it is nearly separated from the rest of Java by a narrow, low-lying peninsula, which is in part at least swampy. The Javanese mainland east of this neck is a forested range of mountains reaching up to over 6000 feet in elevation. This mountainous area is either now a national forest or will be, and the military command of the area, realizing the value of Ujung Kulon to the Indonesian people is very

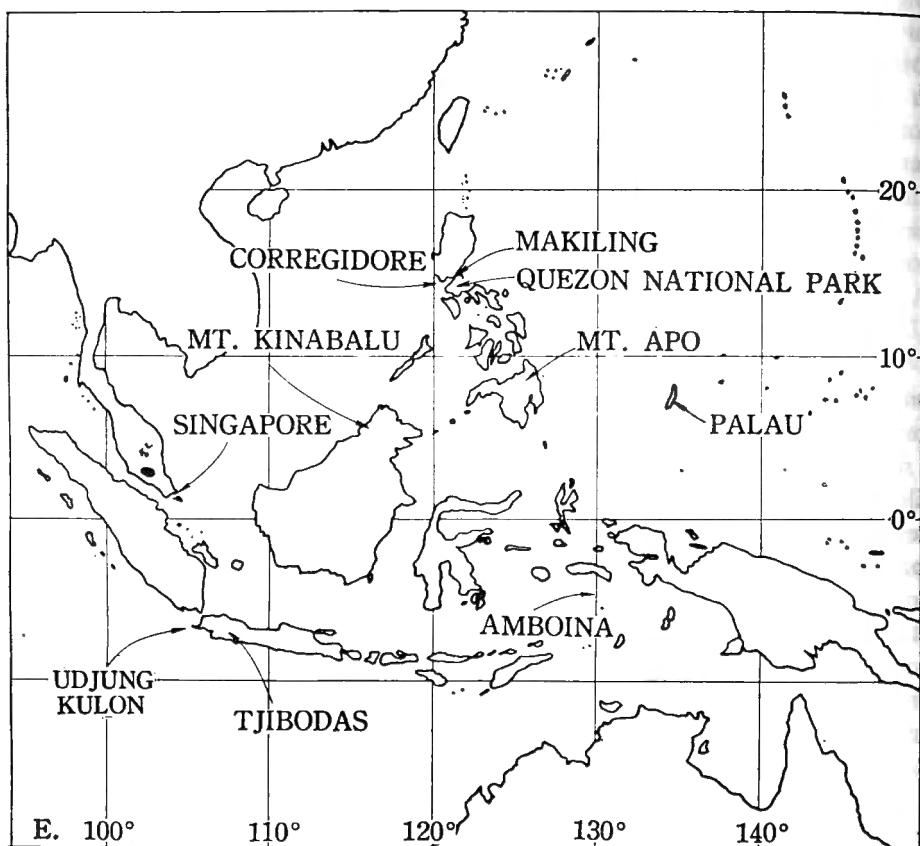


Fig. 2. General location of sites in Southeast Asia suggested as possibly desirable for International Biological Program studies.

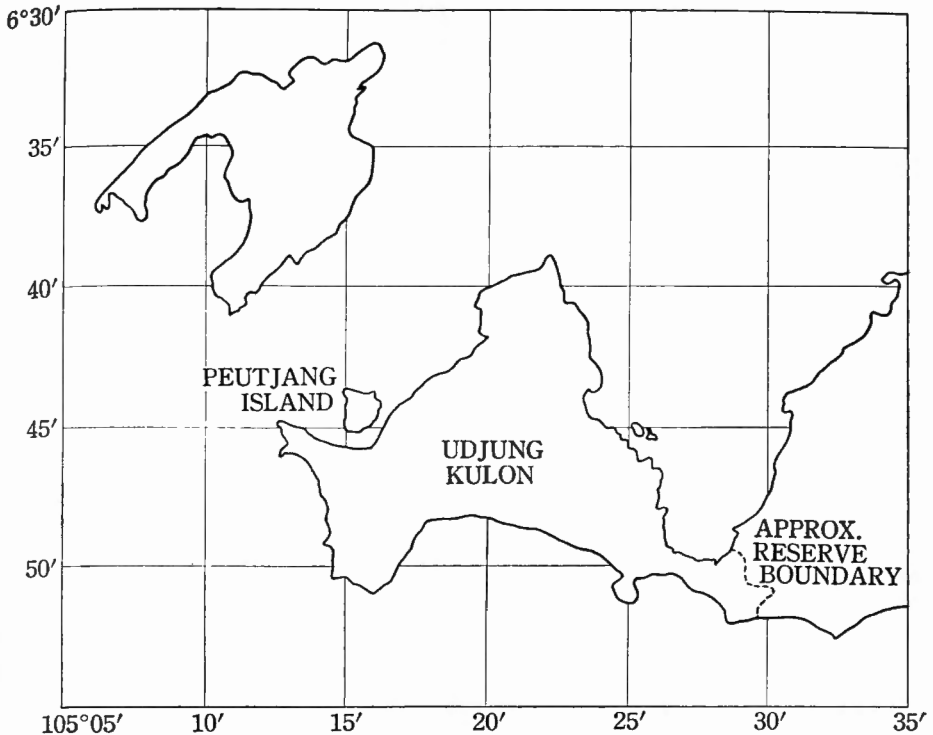


Fig. 3. Ujung Kulon, the national park proposed as the lowland and marine portion of a major International Biological Program study site on the westernmost tip of Java (Fig. 1). The large island shown, Prinsen Island, is not a part of this site. The park headquarters is on Peutjang Island which is reached by a boat trip from Lubang to the northeast on the mainland of Java.

sympathetic to the use of this area as a natural history preserve. He has given assurances of the maintenance of this forest and swamp area as a forest preserve. It serves as an admirable buffer between the otherwise densely populated island of Java and this region.

Ujung Kulon is still a partially unexplored area of approximately 225 square miles; consists of lowland forests with clearings in several places made to provide grazing grounds for the wild animals; the highest peak is approximately 300 meters; the area is very rich in large animals, including the rare Javan rhinoceros and many unique plant species. It offers marine research opportunities that are unusual. Being at about 6 deg., South Latitude, and 105 deg., 20 min., East Longitude, it is a coral-rich area. The famous volcanic series of islands, popularly known as Krakatau, is but a few miles to the north and possibly could be included at least as an unprotected site. Ujung Kulon itself is provided with a very favorable management program and positive protection. It is approximately one easy day's travel from the major scientific center at Bogor and about the same accessibility can be had from the port of entry, Djakarta. The National Biological Institute of In-

onesia and the Forest Institute would provide all the cooperation possible toward the end that this site be cooperatively used as an IBP study area.

This area has been the object of a great deal of scientific study and is a major objective of the people concerned with conservation. Currently there is a book being written about this area by Dr. A. Hoogerwerf, and a year-long study of the Javan rhinoceros has been undertaken by Dr. Jacques Verschuren, under the sponsorship of IUCN. Dr. Harold Coolidge, President of IUCN, has obtained construction of a boat for this Park.

Kartawinata (1965) published a short note on the flora of Peutjang Island, which is a part of this preserve. An intensive survey of this area was made by Dr. Lee Talbot in 1964 for the International Commission on National Parks. The results of Talbot's study are largely presented in four reports, proposals and recommendations which were forthcoming from his study.

C. Singapore

1. Bukit Timah & water preserve
2. Pandan Nature Reserve
3. _____

D. Malaysia

1. Turtle Island reefs near Kuching, Sarawak
2. Mt. Kinabalu National Park, Sabah
3. Bako National Park, Sarawak
4. _____

E. Thailand

1. Evergreen Dipterocarp forest
2. Deciduous Dipterocarp forest and marine area
3. Doi Sutep
4. Phuket

F. Cambodia

1. 200 × 200 mile primitive area with marine site
2. _____

G. Viet Nam

1. Shore area (?Nhatrang)
2. _____

H. Philippines

1. Quezon National Park
2. Mt. Apo
3. Mt. Makiling
4. Corregidor

I. Micronesia

1. Palau, 70 Islands site
2. Marianas-Guam conservation areas and University of Guam Natural Area

J. Southern Ryukyus

1. Ishigari
2. Iriomote
- K. New Guinea
 1. Mt. Wilhelm
 2. Wau (Bishop Museum site)
- L. East Africa
 1. Serengiti National Park
- M. West Indies
 1. Dominica Island
 2. (A Jamaican site)
- N. Central America
 1. Barro Colorado Island
 2. Osa Peninsula, Costa Rica
 3. Barba Volcano, Costa Rica
 4. Tela Watershed, Honduras
 5. Mt. Ayuca, Zamorano Valley, Honduras
 6. San Blas, Nayarit, Mexico
- O. South America
 1. Belem area, Brazil
 2. Galapagos Islands
 3. Proposed Cutibereni National Park, Peru
 4. Rancho Grande, Venezuela
 5. _____

As a major interest is in the development of temperate ecosystems from the tropical, the series of sites would most suitably be distributed from within temperate North America southwestward into the Old World Tropics and southward into the New World Tropics. Such profiles would also serve to a certain extent to enable following the deviation of individual biotic elements from the Old World flora and fauna. A broad range of sites is to be considered for the North American end of the series. Perhaps ideally each of such sites, in agreement with the desiderata above, should be in association with an institution where a productive group of biologists has a similar interest already.

Conclusions

The long-standing interest of the University of Hawaii and the Smithsonian Institution in the tropics has provided considerable capability in the essential fields of tropical biology. Staff members of both institutions and their respective individual and institutional objectives would benefit directly. In addition to the direct scientific benefits obviously to be gained from the project as outlined, there are great extra advantages to be gained from the cultural and scientific contacts and exchanges which this present plan proposes to see carried out between the U.S. and the peoples of the tropical countries where the sites are to be located.