

V. GENERAL SYMPOSIUM "SCIENTIFIC APPROACH
TO RATIONAL USE AND ENVIRONMENTAL PROTECTION
OF THE PACIFIC REGION".

MONITORING ISLAND ECOSYSTEMS:
AN APPROACH FOR CONSERVATION PURPOSES

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Introduction

Monitoring island ecosystems for conservation is herewith suggested as the new theme of the Committee in Conservation and Environmental Protection. The term monitoring means to periodically check or keep track of certain elements, events or phenomena. In our understanding these elements or phenomena are broadly defined as the island ecosystems themselves and as the biological, environmental and/or socioeconomic influences that effect these systems.

During the 13th Pacific Science Congress in Vancouver in 1975, the outgoing Chairman of the Committee on Conservation and Environmental Protection, Dr. Lee Talbot, suggested two alternative program-directives for this Committee. One suggestion was to reorganize the Committee to include the conservation activities of other scientific committees, the other suggestion was to maintain the existing Committee, but to coordinate activities of other committees in the area of conservation.

I was then asked to be the new chairman with Dr. Arthur L. Dahl, from New Caledonia, to act as Vice-Chairman. Since then, Dr. Dahl and I have done some rethinking of these program directives. We have contacted a number of conservation-minded scientists from different areas in the Pacific and have formed a program, which I would like to present at this Congress for consideration.

Background

A review of past Congress resolutions (Doty 1969) has shown that the thrust of the Pacific Science Association, apart from promoting scientific knowledge in the Pacific countries, has been in the area of conservation. Conservation and environmental protection has become a viable and ongoing theme with a tradition which began with the

first congress in 1920 in Honolulu. As a result almost all scientific committees in the Pacific Science Association have incorporated certain aspects of the conservation theme.

Therefore, it would hardly be possible nor desirable to reorganize this Committee to include such activities of the other committees. Instead our committee can only endorse the conservation activities of other committees and concentrate on coordinating such activities with a particular focus.

As a major focus we have chosen the island ecosystems of the Pacific. These ecosystems constitute a unique marine-terrestrial resource for the island nations in the Pacific and the world as a whole. They deserve particular attention in conservation management. Island ecosystems are characterized by their limited nature. Islands are generally small, the areas of each habitat are limited, and total population numbers of species present are generally not large. Island biogeographic theory states that species numbers are related to the size of the available area (among other things), and any reduction in that area will eventually lead to a reduction in species present. As a result problems of conservation in island areas are particularly critical.

Changes in the conservation status of island floras and faunas can come very quickly with development. Rapid action may be required to prevent irreversible extinctions. Yet too little information exists for most island areas to evaluate their conservation status. A simple monitoring program could do much to identify critical conservation problems before it is too late.

The need to concentrate research efforts of high conservation value on the Pacific island ecosystems was particularly emphasized during the 10th Congress in Honolulu (1961), when Dr. F.R. Fosberg had organized the first major symposium on island ecosystems (Fosberg 1965). In spite of Fosberg's appeal, advances in island ecosystems research with practical value in conservation management have only been very slow in coming.

During the International Biological Program (IBP), there was only one project, the Hawaii project of the U.S. IBP, which was specifically concerned with island ecosystems. Its focus was on the biological organization of selected island forest communities. During the 11th Congress in Tokyo in 1966 an island checklist was present-

ted (Douglas 1969) as another initial conservation effort sponsored by IBP. At the 13th Congress in Vancouver in 1975, Harold Brookfield organized a follow-up symposium to the 1961 island ecosystems symposium in Honolulu. Brookfield's symposium was under the sponsorship of UNESCO's MAB Project 7, "Ecology and Rational Use of Island Ecosystems". The Vancouver Congress concluded by stressing five areas of concern for scientific activities in the Pacific Region: mineral resources, human resources, coastal zones, island ecosystems and biosphere reserves. The latter three areas are encompassed in MAB projects 5, 7 and 8. Among these, the island ecosystems MAB 7 project has so far received the least attention in funding in the U.S.

However, the South Pacific Commission (SPC), in coordination with the International Union for the Conservation of Nature (IUCN) organized a conference in 1976 in Apia, Western Samoa. I had the privilege to participate in this Conference as the representative of the Pacific Science Association. The theme of the Apia Conference was "Conservation of Nature in the South Pacific". Major discussion topics were: a regional ecosystems survey, ecologically based development and conservation legislation. Among the 16 resolutions generated from this Conference, resolution 12 called for support of the UNESCO MAB 7 and MAB 8 projects through the Pacific island governments and the continental governments with major responsibilities in the Pacific island region.

Thus, the 1976 SPC-IUCN Conference in Apia reemphasized and reendorsed nearly the same areas which had been proposed in the last Pacific Science Congress in Vancouver.

The new program of the Pacific Science Association Committee on Conservation and Environmental Protection is based on this background.

The Program

The program is divided into four parts:

- A. Analysis of Spatial Variation among Island Ecosystems
- B. Analysis of Dynamic Processes
- C. Methodology and Approaches
- D. Application and Conservation Action

These four areas are open-ended, but focused enough so as to yield progressive results and products, which will be of high conser-

vation value. I will now briefly describe these four program elements.
A. Analysis of Spatial Variation among Island Ecosystems

By this we mean study of vegetation, animal communities, species and habitats in the spatial or geographic sense. Methods involve inventory and mapping of vegetation, climates, topography, soils and land forms. Special emphasis should be given to the distribution and habitat requirements of endemic species, particularly endangered species.

Major progress in this area has been accomplished by Dr. Arthur L. Dahl. Since his appointment in July 1974 as Regional Ecological Advisor to the South Pacific Commission, he has travelled to all major islands in the South Pacific, where he has collected a large amount of information on the major ecosystems of the South Pacific Region. The information was compiled for 20 biotic provinces (named by island group, such as Bismarck Archipelago, Solomon Islands, etc.) and for 73 biome types (i.e. 12 forest biomes, 3 scrub biomes, 1 bog type, 5 grassland or savanna biomes, 3 march biomes, 2 desert biomes, 9 aquatic or semi-aquatic biomes, 3 specialized animal habitats, 2 coastal biomes, 12 reef habitats, including algal and seagrass beds, 6 lagoon types and 15 marine habitats). A two-way overview table in his report allows for a quick spotting of the presence or absence of any of the biome types in each of the 20 biotic provinces. Four physical island types (continental, volcanic, elevated reef, and sea level reef) were similarly identified (as present or absent) in each of the 20 biotic provinces. In his draft report, many of the biome types are further subdivided into major vegetation and habitat types and their status of protection is indicated. In addition, lists of rare and endemic species were compiled and information is given on existing reserve and conservation legislation for each island group (or biotic province).

A copy of Dr. Dahl's draft report is kept on file in the Pacific Science Association Office in Honolulu. The report is intended for publication by the end of this year.

Research projects on endangered species in the Hawaiian Islands will be discussed in this Conference in a paper contributed by Ken Eaker of the Hawaii Field Research Center.

B. Analysis of Dynamic Processes

This program area emphasizes three project elements, namely the impact and response to natural stresses and/or disasters, new stres-

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ses, and the study of long-term changes. Among new stresses we consider particularly the impact of exotic species and animals and the effects of pesticides in island ecosystems. Professor Wodzicki, a member of our Committee is planning to work on a synthesis review of the impact of exotic animal species in the South Pacific island ecosystems. Dr. Marshall, an entomologist stationed in Western Samoa, has worked in the Tokelau Islands on the effect of DDT seepage onto coral reefs. His results have been documented on film, but a detailed report is still outstanding.

Dr. D.R. Stoddart (from the University of Cambridge) has a long standing scientific interest in the effects and recurrence of natural disasters on Pacific island ecosystems. As a member of the tentative U.S. MAB 7 project he was to prepare a synthesis review on this topic. However, the project has not yet received any funding.

The longer-term dynamics in the Hawaiian rain forest will be the subject of another talk in this conference. Here, natural stresses produce symptoms of forest dieback which were initially thought to be the effects of a newly introduced disease or insect pest. Instead, the canopy dieback is associated with rejuvenation processes in this island rain forest ecosystem.

A study of stress factors and responses to natural stresses in island ecosystems will help to better understand the important question of fragility versus stability relationships in island ecosystems. It has become clear through the Hawaii IEP research and the study of the Hawaiian rain forest dieback that the fragility theory of island ecosystems will have to be reexamined. Such reexamination is of particular relevance to conservation management.

C. Methodology and Approaches

This program area on three project elements, namely the ecological significance of traditional cultural practices, on appropriate methods for monitoring island ecosystems and biota and on conservation education.

Traditional cultural practices were a major subject of discussion in the second SPC-IUCN Regional Symposium on Conservation of Nature in the South Pacific at Apia in June 1976. The focus was on using and revitalizing certain aspects of traditional cultural practices for ecologically based development (i.e. ecodevelopment) in the Pacific Island nations, wherever such practices offer a viable and

ethically acceptable alternative to resource development based otherwise on a technology developed by the industrialized continental nations.

Dr. Lance Hill (from the University of Papua - New Guinea) has indicated an interest to work on a synthesis review in this project area for achieving the conservation objectives of our Committee. Monitoring island ecosystems should ideally be based on a thorough knowledge of their structures and functions. These should be a complete inventory of the fauna and flora, with their distribution, abundance and roles in the ecosystem. The dynamics of the system over time should be clearly understood. Knowledge of the minimum size necessary for the ecosystem to function, and of the minimum population numbers required for the survival of each species, would then allow a precise definition of the requirements for conservation.

Unfortunately, this knowledge does not exist for any ecosystem, not even the most thoroughly studied. For island ecosystems where our ignorance is manifold, conservation decisions must be taken on other bases.

Human and material resources available seldom permit even a reasonably complete study of an ecosystem. The challenge of an appropriate monitoring program is to collect the minimum amount of information necessary to detect all significant changes in the system or its components. Fortunately, the interactions within an ecosystem are such that one factor can often serve as an indicator for many facets of the System. A judicious choice of indicators can provide a reasonably full coverage of the ecosystem.

The accuracy with which measurements are made is also important. Too often highly accurate measures made at great have no significance because of samplings error or natural variability. A larger number of gross changes may be more meaningful than a few very precise figures. The level of accuracy chosen should be a function of the kind of conclusions required for monitoring. Similarly, several diverse measures will generally be more useful than one parameter studied in much greater detail.

Forest is the most common natural cover on islands and therefore is of the greatest interest for conservation. As natural forests tend to be reduced by development, the distribution of total forest cover is a simple way of measuring terrestrial conservation status. Forest

cover and other land uses of interest to conservation can quite easily be determined from aerial photographs. Such photographs taken at 5- to 10-year intervals will give a reasonable measure of longer-term changes in major terrestrial habitats. Reduction in forests and other natural habitats is one of the major causes of conservation problems.

At the more local level, specific monitoring sites can be permanently marked and regularly examined for parameters indicative of the state of the ecosystem. Techniques for doing this in coral reefs and lagoons are now being developed by the South Pacific Commission, using area coverage measures and counts of selected species and life forms. Simple definitions based on obvious features permit the method to be used even by non-specialists.

Each island has some critical habitats in need of special consideration for conservation. These may be important breeding areas, lakes, swamps or other sites with small-size or distinctive biotas. Special monitoring methods may be required for these areas.

Such monitoring activity, which provides the basic information input for conservation management, can only have success, if the respective island people support and participate in the process. Support and participation by island people can only be expected, where conservation education is included as a major aspect of the program.

This was recognized early by the South Pacific Commission at its First Regional Symposium on Conservation of Nature, Reefs and Lagoons in Noumea, New Caledonia in August 1971. Further emphasis has been given to conservation education in Apia in 1976 at the Second Regional Symposium. Mrs. Margie Falanruw from Yap Island (Western Carolines) has been an IUCN consultant on environmental and conservation education to the South Pacific Commission. She is a member of our Committee and will cover this important aspect in our program as much as this is possible from her perspective.

Of course, conservation education should be an integral part of any conservation-oriented research, initially when a project is suggested by the researcher and endorsed by the land administrator and particularly at the completion of the project where it is an important element in the information transfer phase.

D. Application and Conservation Action.

Three activity areas are considered of particular value for the application of conservation measures: the preparation of field guides,

appropriate suggestions for resource-use options and alternatives and efforts directed for protecting critical habitats or to restore them where necessary.

The preparation of field guides includes such items as the description of island floras with keys and illustrations, the description of island vegetation and habitats with maps and profile diagrams, or the monographic treatment of important island animal groups. Emphasis is put on illustrative handbooks which are both scientifically sound but easy to understand and thus useful to the island people. Major progress in this direction has been made in recent years by the Wau Ecology Institute in Papua, New Guinea under the directorship of J.L. Gressitt. A series of field guides has been completed on New Guinean frogs, beetles, upland birds and other life forms.

Appropriate suggestions for resource-use alternatives should always be included as an important follow-up of such studies which deal with the description and mapping of vegetation, habitat and land-use patterns. The point is that such biophysical land classifications yield information value on land capabilities, which, with minor additional effort, can be translated into appropriate suggestions for land-use options or alternatives by keeping an overall perspective for ecologically based development. The East-West Center Environment and Policy Institute (EAPI) at the East-West Center in Honolulu under the directorship of W.H. Matthews is engaged in such activities. The EAPI is concerned about bringing the environmental impact assessment procedure into the resource-development projects in all tropical areas of the Pacific. Recently, the institute held a workshop conference on "forest land assessment for sustainable uses" in which procedures for land classification and suitability ratings were reviewed, synthesized and adapted for ecologically based development.

Efforts for conserving critical habitats are a continuing need particularly in tropical island ecosystems. Such efforts are best directed through an overall project of inventory and description of vegetation, habitat and animal communities as was outlined under part A of this Committee's program. As mentioned before, the South Pacific Commission in conjunction with IUCN has taken initiatives in this direction. However, a major impediment to developing an adequate system of natural areas and ecological reserves are increasing and con-

flicting socio-economic demands of the natural resources. It is therefore important that a dialogue is established and continued between the land researcher or naturalist who makes the suggestions and the land administrator who makes the decisions. (This project element is of vital concern for the realization of conservation efforts in the Pacific Island region, although it is certainly not the only one of concern.

Summary and Conclusions

Conservation and environmental protection is such a broad area of concern in the Pacific Science Association that a committee working for this goal is in a certain danger of becoming diffused by too many tasks. It is therefore necessary to have a program with a certain focus, which is neither too narrow nor too broad.

The area of focus, as resulting from a traditional concern of the Pacific Science Association, are the island ecosystems of the Pacific. The program directives as outlined are seen in four parts with each three project elements which are in summary as follows:

- A. Analysis of spatial variation among island ecosystems
 1. Ecological inventories
 2. Vegetation and habitat descriptions, land capability classifications and mapping
 3. Habitat-requirement studies of endemic species (particularly endangered ones)
- B. Analysis of dynamic processes
 4. Impact of natural disasters (such as tsunamis, droughts, floods, etc.)
 5. Impact of new stresses (such as introduced animals and plants, use of pesticides and their effects, etc.)
 6. Study of long-term changes (such as changes in land-use patterns or changes in natural communities)
- C. Methodology and approaches
 7. Ecological significance of traditional cultural practices
 8. Appropriate methods of monitoring through remote sensing and field studies using biological indicators
 9. Conservation education and teaching of appropriate methods
- D. Application and conservation action
 10. Preparation of field guides to island organisms and ecosystems

11. Appropriate suggestions for resource-use alternatives, based on land capability research

12. Ecosystem protection and restoration

This program is open-ended, and flexible, but it provides for a framework in which progress can be shown in certain increments. Such incremental progress is intended for presentation at the present and future congresses and inter-congresses of the Pacific Science Association.

An important ingredient of this program is an ecological orientation towards synthesis. Committee members are encouraged to participate who have an interest in certain of the project elements. At the same time they come from different areas of the Pacific and thus bring together expert knowledge of different islands and island groups. They are island groups. They are encouraged to present in-depth analysis and synthesis reviews, which inform periodically of the overall progress in each of the four areas of the Program.

RESERVES OF THE SOVIET FAR EAST AND THEIR ROLE FOR NATURE CONSERVATION

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In Asia the Far East is the region of special scientific significance. A smooth change of ecosystems from Arctic deserts up to the humid subtropical forests can be noticed here. Absence of continental glaciation in the past and essential migration of floracoenotic complexes connected with it made it possible for vegetation to develop for a long period of time without any notable alterations. Multiple thermal springs at the continental edge - the result of constant volcanic activity, promoted this, too. The Far East of Asia is a place where nemorose vegetation began to form earlier than in the other regions of the planet and where it is continuously developing nowadays. Nemorose formations of the Far East show a rare combination of archaic floristic basis (floristic connections with humid subtropics are clearly seen) with the advanced phytocoenotic structure and the far-gone rhythmological differentiation. These specific features determine a high scientific significance of southern nemorose formations for further development of biogeocoenology and a necessity of a special approach to their preservation.