

CONCEPTUAL FRAMEWORK FOR THE MANAGEMENT  
OF THE VIRGIN ISLANDS BIOSPHERE RESERVE

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## ABSTRACT

The Virgin Islands National Park was designated a Biosphere Reserve by UNESCO in 1976 and dedicated in 1983. It is part of an international network of areas, representative of the world's natural diversity, managed to integrate conservation and development. Because of the more limited objectives of a national park, a biosphere reserve can only fulfill its purpose if it encompasses a more diverse area, both geographically and conceptually. A fully functioning reserve would seek to develop and disseminate the knowledge, skills and attitudes needed to attain sustainable use of natural resources. Management objectives would cover a range of activities in conservation, research, education, training, communication, and resource development that is sensitive to both man and nature.

The purpose of this report is to outline a conceptual framework for management of a Biosphere Reserve in the Virgin Islands. A synthesis of data on (1) the distribution of marine habitats of the protected areas of the U.S. and British Virgin Islands, (2) marine resource use around St. John, and (3) issues of concern to marine resource managers and users provided much of the background information.

Activities in the Virgin Islands Biosphere Reserve to date have been funded mainly by the National Park Service and implemented through VIRMC. Most progress has been made in research and least in resource development and training. This reflects funding through the Park's research budget which has provided a strong initial impetus to the Program. However, a fully functioning Reserve will evolve more rapidly when the selection of priorities is made within a coherent and long-term framework, not as an element of research for the National Park.

The evolution of a fully functioning Biosphere Reserve can be promoted by continuing the ongoing research program, adding new activities in resource protection for the heavily used northwestern bays, and guiding sensitive development of the Coral Bay area. These activities should improve cooperation among users and managers and make possible a collaborative approach to designing a Reserve Program that will deal effectively with major resource management issues. An ad hoc committee established for this purpose could evolve into a more formal Reserve Management Committee made up of representatives of the various interest groups and appropriate federal and territorial government agencies. Its function would be to develop and oversee the implementation of a Reserve Management Plan. While much could be accomplished through cooperative arrangements between members of the Management Committee, a strong program would require a small but well trained staff. Funding could either be sought through territorial or federal sources, or perhaps through grants from private foundations. Given the international aspects of the Program, the Management Committee and staff might be most productive working through one of VIRMC's members having a regional perspective, such as the Island Resources Foundation, the Eastern Caribbean Natural Area Management Program, or the newly forming Eastern Caribbean Center of the University of the Virgin Islands.

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## INTRODUCTION

The Man and the Biosphere Program (MAB) was launched by UNESCO in 1971 to foster international cooperation in improving people/environment relations. It seeks to provide the information needed to solve the practical problems of managing natural resources and assure a kind of development which respects both people and nature. A major element of the Program is the Project on Biosphere Reserves, which promotes the establishment of an international network of areas, representative of the world's natural diversity, managed to integrate conservation and development.

In concept the biosphere reserve is a bold innovation in resource management. It provides an international framework for relating management directly to people's needs, and for improving cooperation at the local, regional and international levels. In practice, efforts have centered on the designation of new reserves, while attention to actual on-the-ground management has often lagged far behind. In many places, including the U.S., biosphere reserves were superimposed on existing parks, forests, or experimental areas with little exploration of their added purposes or functions and little interaction with local communities, or their governments, academic institutions, resource users or resource managers. Thus, in developing a Biosphere Reserve in the Virgin Islands, there are few models to examine and a general lack of experience.

The overall purpose of this report is to outline a conceptual framework for management of the Virgin Islands Biosphere Reserve, taking into account guidelines established at the international level, as well as the specific natural, social, cultural, economic, and institutional character of the region. More specifically the report is intended to present the results of Project II.1 of the Virgin Islands Resource Management Cooperative (VIRMC), funded by the National Park Service (NPS).

## BACKGROUND

The Virgin Islands Biosphere Reserve (VIBR) was designated in 1976, along with 28 other federally managed areas, and dedicated in 1983. Among these 28 Reserves, the VIBR is unique in that it is the only one (1) located in a developing region of the world, (2) representative of marine and terrestrial habitats of a small tropical island, and (3) having specific funding for building a Biosphere Reserve Program (Gregg, 1985). It thus provides singular opportunities as a demonstration area, both within the U.S. and within the Eastern Caribbean. The Program, being developed through cooperation between the NPS and VIRMC, provides an ideal means for focusing U.S. research and technical cooperation, both geographically and thematically, in the region.

Because of the more limited, and legally mandated, objectives of national parks, a biosphere reserve can only fulfill its full functions if it encompasses a larger, more diverse area, both geographically and conceptually, and if it is provided with adequate human and financial resources. The purpose of this paper is to explore ways in which the transition to a fully functioning biosphere reserve might be brought about in the Virgin Islands.

In exploring these alternatives, it is important to keep in mind the pattern of federal and territorial jurisdictions with respect to St. John and surrounding waters. The most immediately important jurisdictions for the development of Biosphere Reserve activities include:

- National Park Service: management of Virgin Islands National Park.
- Virgin Islands Department of Conservation and Cultural Affairs: research on, and regulation on capture of, fish and wildlife; zoning and regulation of development; enforcement of all environmental regulations; and regulation of historic and archaeological sites.
- Virgin Islands Planning Office: coordination of planning activities, formulation of long range plans.

#### CONCEPT AND PRACTICE

Although there are presently 252 Biosphere Reserves designated in 66 countries (Man and the Biosphere Program, 1986), about 82% have been superimposed on existing National Parks (Miller, 1983). Few are managed differently than they were before the Biosphere Reserve designation. Further, there is no single, accepted model for management, although after almost ten years of experience worldwide, there is a growing consensus on general concepts (see, for example, the "Action Plan for Biosphere Reserves", UNESCO, 1984 and "Report of First Meeting, Scientific Advisory Panel for Biosphere Reserves", UNESCO, 1985). Therefore, in developing a fully functional Biosphere Reserve in the Virgin Islands, it should be recognized from the outset that there is no clear model or prescription to follow, only broad concepts.

The literature on Biosphere Reserves is voluminous and has been reviewed and synthesized by MacFarland (1983). Based on this and recent papers by MAB (1985) and Eidsvik (1984), there is a consensus that the following objectives are central to the Biosphere Reserve concept:

- **Conservation of Ecosystems:** conserve ecologically representative areas, components of which are managed for a variety of objectives from complete protection to intensive, yet sustainable, production.
- **Research:** promote and facilitate monitoring, and basic and applied research, especially that oriented to management.
- **Education:** provide opportunities and facilities for education and training, all sectors and levels (scientists, managers, resource users, educators, students, decision-makers).
- **Management:** study and document traditional and current resource uses and management strategies, experiment with methods and adaptations suited to present day conditions, and determine means for restoring degraded ecosystems.

- **Integrated Development:** work with local communities, decision-makers, scientists, and managers to find practical and sustainable strategies for dealing with the complex and interrelated environmental, land use, and socio-economic problems of development.

- **Communication:** share with the local community, the region, and similar ecological zones worldwide the experience gained through monitoring, research, management, appropriate resource development, and education and training.

To carry out these objectives, a Biosphere Reserve Program must deal with both protected natural areas (usually referred to as "the core zone") with minimum human intervention, and developed areas characterized by various land and resource uses which modify the natural environment. In those cases where the boundaries of the Reserve encompass a specific developed area, this area is referred to as the "buffer zone". In those cases where the boundaries of the Reserve are limited to the core area, the associated developed areas are referred to as the "zone of cooperation". In this situation the zone is spatially flexible and expands as more participants cooperate in the reserve program. Through comparison of the natural and developed areas, insights can be gained on the most effective resource use strategies that are both sustainable and equitable to the various resource interest groups. To be fully functional, a Biosphere Reserve Program would also have to encompass large enough natural and developed areas to accommodate all of the objectives of a Biosphere Reserve without conflict.

As Eidsvik (1984) has noted, under today's criteria, a Biosphere Reserve should not exist if it consists **primarily of a core area** such as a national park. Such designation only leads to more confusion about the role of the reserve compared to the role of the national park on which it is superimposed. In essence, North American national parks emphasize protection through regulation, whereas biosphere reserves emphasize management through cooperation and consensus. To clarify and contrast the differences between North American national parks and biosphere reserves, Table 1 has been adapted from Eidsvik (1984).

#### CURRENT POLICY

While the basis for U.S. participation in the MAB Program is defined in public law and policy statements, there is, currently, no approved U.S. policy on biosphere reserves themselves. The nomination of U.S. areas for designation under the UNESCO Man and the Biosphere Program (MAB) as biosphere reserves is made by the U.S. National Committee for MAB on the advice of the Project Directorate on Biosphere Reserves. The Directorate is made up of representatives from government agencies, universities, and private organizations. The Secretariat for the National Committee operates on a miniscule budget through the Department of State, and determines priorities and coordinates activities. Areas are chosen within specific guidelines for the identification, evaluation and selection of biosphere reserves in the United States adopted by the Secretariat (US-MAB, 1983).

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Table 1: Comparison of national parks and biosphere reserves  
(source: modified after Eidsvik, 1984).

| <u>Biosphere Reserves</u>                                                      | <u>National Parks</u>                                                |
|--------------------------------------------------------------------------------|----------------------------------------------------------------------|
| * almost 10 years old                                                          | * more than 100 years old                                            |
| * internationally designated                                                   | * nationally designated                                              |
| * selected to be representative of one of the world's eco-systems              | * selected because of outstanding scenic or recreational values      |
| * no prescribed management structure                                           | * prescribed management structure                                    |
| * a management concept                                                         | * a management category                                              |
| * cooperative approach                                                         | * regulatory approach                                                |
| * emphasis on science, research, training and extension                        | * emphasis on protection, recreation and education                   |
| * outward looking - concern with management integrated with surrounding region | * island mentality - tendency to isolation within fixed boundaries   |
| * local management committee                                                   | * occasional local advisory groups                                   |
| * more complicated to establish and manage                                     | * less complicated to establish and manage                           |
| * extensive monitoring                                                         | * occasional monitoring                                              |
| * interdisciplinary research involving natural and social sciences             | * research often narrowly focused and oriented to single disciplines |

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To date, 41 areas have been nominated and accepted as Biosphere Reserves in the U.S. They include federally managed areas, such as National Parks, National Monuments, National Forests, National Wildlife Refuges, and Experimental Forests and Ranges; and state and private areas managed for research, natural area protection, or multiple uses. Once designated and approved by UNESCO, the biosphere reserve label confers no special legal status or formal management implications.

The management of biosphere reserves has been the subject of recent workshops, but no management guidelines have been adopted by federal agencies or the U.S. National Committee for MAB. In practice, in the U.S. strong emphasis has been placed on the research objectives of biosphere reserves. This is reflected in the publication, "Guidelines for the Identification, Evaluation and Selection of Biosphere Reserves" (U.S. MAB, 1983). Internationally, however, increasing emphasis is being placed on a more balanced view of the role of biosphere reserves (MacFarland, 1983; UNESCO, 1984; and UNESCO, 1985).

A strong research orientation is reflected in the General Management Plan for the Virgin Islands National Park (NPS, 1983). Under the section on management of the natural resources, it states as objectives to "manage the park as an international biosphere reserve; actively participate in the Man and the Biosphere program; and provide appropriate research opportunities to the national, international, and Caribbean scientific communities." No specific mention is made of the objectives relating to training and education, nor to cooperation with the local community or within the region to enhance the contribution of natural resource management to sustainable development.

### EVOLUTION OF A VIRGIN ISLANDS BIOSPHERE RESERVE

Although biosphere reserves may be designated by the stroke of a pen, they are functionally established through the effective cooperation of different elements of the community (resource users, scientists, managers, educators, students and politicians) over time. Functional links are as important as legal instruments, and personal relationships as important as institutional mandates. Thus, if the VIBR (presently superimposed on the Virgin Islands National Park) is to evolve to address the full range of biosphere reserve functions, it will happen through a long-range process that builds the required confidence and relationships, and then structures this cooperation into management procedures.

#### Progress towards objectives

In exploring the potential paths of evolution for the Biosphere Reserve, it is perhaps useful to assess the activities of the Park/Reserve to date, and to compare them to the objectives noted earlier for biosphere reserves in general.

1. Conservation of Ecosystems: The biosphere reserve project has as a major objective the establishment of a network of protected areas representative of the world's ecosystems. For this purpose, the classification of Udvardy (1975) is used to divide the world into biogeographical provinces. The VIBR falls within the Lesser Antillean Biogeographic Province and contains most of the life zones common to the region. It does not contain the rain forest and cloud forest life zones characteristic of the higher elevations of the active volcanic islands, the low and dry areas of limestone islands, nor the deep water life zones outside of the coastal platform (Putney, 1983).

The conservation of the major marine ecosystems of the Virgin Islands is, as far as is presently known, being achieved through the Park/Reserve. While there is a perception by park managers and resource users, especially fishermen and dive tour operators, that the marine resources of the Park/Reserve are stressed and deteriorating, this is only now being documented. Long-term monitoring programs have been established for the reefs, and the fish and shellfish populations of the Park/Reserve. Other transects in shallow water marine environments, which could possibly be reoccupied by the same researchers, have been set up in areas on St. John outside of the Park/Reserve, and in selected areas of the British Virgin Islands (BVI). These sites may be helpful in establishing baseline data for future comparisons.

Monitoring activities are of special importance regionally since there is very little of this kind of research currently being carried out.

While the terrestrial ecosystems of the Park/Reserve have over hundreds of years been exploited by man, within the park these ecosystems are now being allowed to follow natural evolutionary paths, although they will of course not return to their original state and will contain many exotics. Long-term vegetation plots have been established in three watersheds within the park to assess mortality, growth rates and successional patterns for forest trees. In order to ascertain how these plots differ from the original vegetation, it may be useful in the future to compare them with similar plots in areas of the British Virgin Islands which are presumed to retain their natural composition (east slope, Beef Island; Gorda Peak, Virgin Gorda; and Guana Island). The conservation objectives of the Reserve would be better met by the inclusion of these sites, especially if it is determined that these areas do indeed contain original terrestrial ecosystems of the Virgin Islands.

2. Research: Research on the Park/Reserve is funded by the NPS, and since 1983 carried out by members of VIRMC. Research projects completed include:

- mapping of marine ecological communities;
- collection of marine biota;
- monitoring of anchor damage;
- study of white band disease;
- assessment of sedimentation effects on the marine environment;
- mapping of fisheries habitats;
- assessment of fish and shellfish stocks;
- studies on utilization of the Reserve by artisanal fishermen and on the socio-economic and cultural role of fishing and shellfishing;
- characterization of the Lesser Antillean regional fishery;
- establishment of a basis for zoning of the marine areas of the Reserve;
- synthesis and mapping of marine resource use and degradation data;
- definition of concepts for Reserve management;
- video tape on the Biosphere Reserve Conference;
- monitoring of coral reefs, fish stocks, and terrestrial vegetation;
- determination of historical land use patterns;
- assessment of the effects of runoff on marine environments; and,
- coastal protected areas workshop for the Eastern Caribbean.

Further research projects are in the process of completion. These include:

- data base management;
- long term impacts of watershed use deduced from salt pond deposits;
- trends and impacts of boating and recreational uses of marine resources;
- assessment of anchor damage and carrying capacity of seagrass beds for turtle populations;
- assessment of Buck Island fish and shellfish populations;

- detailed vegetation mapping of long term monitoring sites;
- study of the geochemistry of St. John and influence on marine systems; and,
- synthesis of research carried out in the Virgin Islands National Park.

This research represents the main thrust of VIRMC activities in the Biosphere Reserve to date, implemented through some 25 individual projects since 1983. One of the main benefits of the research being carried out through the Cooperative is the multi-institutional and multi-disciplinary approach with researchers familiar with the Virgin Islands environment.

A considerable amount of research was carried out in the Park/Reserve prior to initiation of VIRMC activities. Compilation of a research history, a comprehensive bibliography and an information synthesis are being carried out by the Park's Research Biologist.

A research station specifically geared to the Biosphere Reserve is under construction. Additional research facilities are maintained by the University of the Virgin Islands within the Park/Reserve at the Ecological Research Station at Lameshur Bay. To date the Station has not taken part in the Biosphere Reserve activities of VIRMC, but the potential of the facility for supporting research, education, and training as part of the Reserve Program should not be overlooked.

While there is no doubt that research has contributed to a better understanding of the Park/Reserve and surrounding areas, a long-term research plan is needed to systematically develop the knowledge and management approaches required for sustainable use of the ecosystems of the Virgin Islands. The plan can be developed in detail only when the most important management issues have been identified and prioritized. The recently completed Virgin Islands National Park Natural Resources Management Plan provides specific guidelines for research and management as a national park, but the Biosphere Reserve dimension still requires further definition. Thus, the research plan for the Biosphere Reserve should logically form a part of a wider plan for the overall management of the Biosphere Reserve Program.

3. Education: Activities related to education and training have so far involved local primary and secondary schoolchildren through the NPS' ongoing environmental education program, and various segments of the local community through occasional articles in local newspapers. Some of the research projects have also had training and education components, including the use of community volunteers and student research assistants from the University of the Virgin Islands, workshops, and meetings and consultations with individuals and interest groups. A number of lectures and seminars have been offered to students at the University of the Virgin Islands and the Virgin Islands Ecological Research Station by VIRMC researchers.

While these isolated events have had educational content, an overall framework for an ongoing Reserve educational and training program relevant to the various groups involved in the use and management of St. John's resources has yet to be developed. The Research Station, under construction by the NPS,

might well serve as a focal point for a more systematic program designed for resource users, resource managers, scientists, administrators, educators, and upper level students in resource management. Especially needed are the materials and appropriate format for the teaching of management approaches geared to the small island setting. These would be of great value locally as well as for resource managers from the Eastern Caribbean and other tropical island regions. The University of the Virgin Islands' Eastern Caribbean Center, just now being established, potentially could play an important role in making the link between local training and education activities and those of other island nations of the region, especially at the professional level. Other members of VIRMC, such as the Island Resources Foundation (IRF) and the Eastern Caribbean Natural Area Management Program (ECNAMP), already have many links with natural resource management activities in the Eastern Caribbean, and could also link up their activities with those of the Reserve.

4. Management: Current activities through VIRMC has begun the process of orienting research to answer some of the basic questions of resource management. Many of the present day use patterns for marine resources of the St. John coastal waters in general, and for the Park/Reserve in particular have been documented. Research has looked outward from the Park/Reserve to cover the broader resource system of St. John and its coastal waters. For purposes of comparison, research has in some cases extended to the British Virgin Islands and the Lesser Antilles as a whole. Current uses of the marine resource system, jurisdictions, and restrictions on marine resource use are being mapped. Marine resource issues causing the greatest conflicts between user groups have been identified and means are being sought whereby these conflicts can be discussed and solutions developed by the user groups themselves. This process is in itself a new management approach which goes beyond the immediate boundaries of the Park/Reserve, includes the marine resource system of St. John users, and seeks consensus and cooperation at a practical level without formal structures. While this kind of management has been initiated through funded research, a mechanism is needed to assure continuation after the research projects conclude.

5. Integrated Development: Much of the information derived through the research program is valuable for guiding decisions regarding the integrated development of small Caribbean islands. For example, the study undertaken to characterize fisheries in the Lesser Antilles provided specific recommendations on how the Reserve could best contribute to fisheries management and development in the region. Studies of the land use history and present sedimentation patterns on St. John have been correlated with physical evidence to determine the effects of different land uses on coral reef development. Such information is essential to improving development decisions.

These contributions of information for decision-making are essentially spin-offs of research activities. However, more focused demonstration projects would have greater impact, and the potential for further contributions of the Reserve Program to this objective is considerable. For example, on St. John, intensive development has concentrated on the western side of the island, while the middle portion of the island is National Park. The small remaining area at the eastern end of St. John around Coral Bay has to date not been

intensively developed, and a few residents of the area retain some elements of traditional West Indian lifestyles. Some residents and resource users of this area are concerned that these traditional ways be encouraged, that the historical resources of the area be developed, and that environmentally sound development patterns be observed.

Coral Bay thus offers an ideal opportunity for promoting the integrated development aspects of the Reserve Program. Working with the local community, decision-makers, managers, scientists, and educators, the Program could experiment with, demonstrate, and promote practical and environmentally sound solutions for dealing with the complex and interrelated environmental, land use, socio-economic, and cultural aspects of development.

Specifically, existing proposals to restore the historic Estate Carolina Bay Rum Factory site for educational purposes, library, community center, and 4-H Club center could be promoted and coordinated under the Reserve Program. The enormous educational potential of the Fortsberg Historic Site could be developed. The proposed development of a marina facility to serve fishermen as well as yachtsmen and dive operators, could be promoted. Cooperation with the community in establishing these and other environmentally sound and culturally sensitive development concepts could be an outstanding example of the positive role the Reserve could play in promoting integrated development. Should these and other projects come to fruition and positive achievement be demonstrated, Coral Bay could become a center for training activities for resource managers from the region, especially because of the proximity of the Lameshur Bay Field Station facilities.

6. Communication: Activities related to improved communication among resource users, resource managers, scientists, community groups, educators and politicians have taken place on an intermittent basis with the involvement of several groups. The largest activity to date was the holding of a "Workshop on Biosphere Reserves and Other Protected Areas for Sustainable Development of the Small Caribbean Islands" which was held at the time of the inauguration of the VIBR in May, 1983. The workshop involved some 43 professional-level participants from sixteen Caribbean islands, the U.S., and international organizations. A video program was made from the presentations at the workshop.

Shorter meetings on the Biosphere Reserve and its purposes have been held with NPS employees and fishermen, and research on marine resource issues discussed. Discussions have been held with fishermen and charter boat and dive tour operators on present use patterns, resource issues and conflicts. Information gathered from a variety of sources has been fed back to the users for their comment and correction, giving them an opportunity to see how their own observations fit into those of others and to become familiar with overall use patterns, issues, and conflicts beyond their immediate interests or activities.

Articles in the local newspaper have provided information at the local level, while articles in professional journals (Gregg and McGean, 1985; Rogers, 1985; and Rogers and Zullo, 1985) have made highlights of the

experience of the Park/Reserve available to resource managers worldwide. The publication of the final reports on the various VIRMC research projects will make the results of the VIRMC studies available to a wider technical audience.

Finally, a VIRMC workshop on coastal protected area management for small islands has been presented. The workshop reviewed the results of the Biosphere Reserve Program to date with resource managers from the Virgin Islands and the Lesser Antilles, while at the same time comparing experiences in the rest of the Eastern Caribbean. The workshop was co-sponsored by VIRMC, the University of the Virgin Islands, and the Lesser Antilles Coastal Zone Management Project of the Commonwealth Science Council (based in London).

In summary, activities have been initiated during the past three years in subject areas relevant to the major objectives of the Reserve. Most are at a beginning stage, especially those related to integrated development, and to education and training. These activities have been made possible with National Park Service research funding, but a mechanism needs to be developed to assure long-term continuation. Activities are justified, planned and executed within the National Park framework with thought given to the added Biosphere Reserve dimension. This has provided a strong initial impetus to the Program, but it would seem that a fully functioning Biosphere Reserve will evolve most rapidly when the selection of priority activities is made within a coherent and long-term Biosphere Reserve framework, not as a spin-off of research for the National Park. This implies a broadening of the funding base to complement the Park research funding, the development of an overall management plan for the Biosphere Reserve Program, and at least minimal staffing. The plan would include detailed consideration of the priority actions needed to achieve the long-term Biosphere Reserve objectives outlined above, while respecting the mandates of the National Park within its boundaries. A summary of the central management issues is presented in Table 2 together with potential alternative solutions.

#### BOUNDARIES AND ADDITION OF NEW AREAS

As the management concepts for biosphere reserves have evolved, it has become apparent that the superposition of a Reserve on a National Park will only create confusion unless a coherent plan of action is developed within the framework of the Reserve, respecting the original mandates of the National Park. The need in the case of the Virgin Islands, therefore, is to initiate a process that will lead to a fully functioning Biosphere Reserve. This is especially challenging given the history of both the National Park and the Biosphere Reserve on St. John where there was little local participation in the decision-making process (Boyer, 1984). This has left a legacy of suspicion and, in some cases, outright opposition that will only be overcome when there is a clear perception that the Biosphere Reserve will serve the needs of a number of the community's diverse interest groups (Olwig, 1980).

Given this history, it is probably premature to discuss the expansion of the Biosphere Reserve boundary on St. John until major elements of the community see it in their interest to do so. This will undoubtedly require considerable time (perhaps even a decade), appropriately trained and

Table 2. Alternative approaches to management issues

| Issue            | Objective                                                     | Alternatives                                                                                                                                      | Pros                                                                                                                                                                                                                | Cons                                                                                                                                                                                                                                                                                                                                                                   |
|------------------|---------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Management Plans | Provide coherent program framework to guide activities of BR. | 1. Maintain BR management programming as function of NPS budgeting procedures.                                                                    | No outside funding needed to establish program framework.                                                                                                                                                           | Removes decision-making from local and territorial control and eliminates meaningful local participation.<br><br>Blurs distinction between NP and BR.<br><br>Requires policy definition at top levels of federal government.<br><br>Requires retraining of NPS staff, revision of staff position descriptions, revision of NPS policy and restructuring of NPS budget. |
|                  |                                                               | 2. Create BR Steering Committee composed of representatives of user and interest groups and resource managers, to develop and oversee BR program. | Retains decision-making at local and territorial levels and stimulates local participation.<br><br>Clarifies distinction between NP and BR.<br><br>Potentially strengthens role of VIRMC as coordinating mechanism. | Requires new sources of funding.                                                                                                                                                                                                                                                                                                                                       |

Table 2 (Continued). Alternative approaches to management issues

| Issue      | Objective                                                                                            | Alternatives                                                                                                                                  | Pros                                                                                                                                                                                                       | Cons                                                                                                           |
|------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| Boundaries | Expand so Reserve can achieve all BR objectives, especially those not compatible with NP management. | 1. Maintain NP as "core" and "buffer" zones and use flexible "area of cooperation." Emphasize BR program rather than its physical boundaries. | Removes need to raise a sensitive issue with community.                                                                                                                                                    | More difficult to justify spending on program activities outside of Reserve boundary.                          |
|            |                                                                                                      | 2. Encourage surrounding communities to petition for expansion of boundaries when they feel benefits would warrant it.                        | Leaves the decision on boundaries to communities that will be affected.                                                                                                                                    | Requires extensive confidence building activities over many years.                                             |
|            |                                                                                                      | 3. Encourage BVI Government to consider designation of complementary BR units and coordinate management through VIRMC.                        | Could include less altered ecosystems than are found on St. John.<br><br>Could emphasize integrated development, training, and educational objectives now weak.<br><br>Could open new avenues for funding. | Could complicate administration and funding.<br><br>May lead to abandonment of some BR objectives in the USVI. |

Table 2 (Continued). Alternative approaches to management issues

| Issue    | Objective                                                               | Alternatives                                                                                    | Pros                                                                                     | Cons                                                                                                                                                      |
|----------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| Staffing | Provide means for implementation of BR program.                         | 1. Use NPS staff and VIRMGC contractees as at present.                                          | Current NPS funding arrangements can be maintained.                                      | Relies on NPS budget and effectively concedes programming to NPS funding priorities.                                                                      |
|          |                                                                         | 2. Hire BR Program Coordinator to seek non-NPS funds and implement work program through VIRMGC. | Allows implementation of distinct BR program, coordinated with but independent from NPS. | Requires new sources of funding.                                                                                                                          |
|          |                                                                         | 3. Attach NPS employee to UVI as Program Coordinator.                                           | Would partially separate BR program from NP, while still using NPS funding.              | Decreases need for local commitment to program.                                                                                                           |
| Funding  | Provide financial support to programming and implementation activities. | 1. Continue to rely on NPS for most funding.                                                    | Present mechanisms for programming and staffing can be used.                             | Decreases need to seek wider participation in and justification of BR program.                                                                            |
|          |                                                                         | 2. Seek outside funding from a variety of sources.                                              | Lessens dependence on single funding source.<br><br>Increases local control.             | Blurs distinction between NP and BR.<br><br>Requires hiring and funding of independent BR Coordinator.<br><br>Broadens the potential scope of activities. |

motivated staff, the establishment of good working relationships within the community, demonstrated ability to implement activities seen as being beneficial, and the participation of a wide range of groups in relevant activities and decision-making. This suggests that, for at least the next few years, the activities of the Biosphere Reserve should deal both with areas within the Park/Reserve and a larger "zone of cooperation" not within the official boundaries. When and if surrounding communities find it in their interest to be included within the boundary of the Reserve, adjustments then could be made accordingly.

Most inhabitants of St. John use both marine and terrestrial resources, and it is the marine resource uses that cover the widest areas geographically. Research to date indicates that in varying degrees marine resource users utilize the shelf, cays and islets of both the U.S. and British Virgin Islands. (These same areas are also used in varying degrees by resource users from St. Thomas and the British Virgin Islands as well. Activities aimed at resolving the marine resource issues of importance to residents of St. John must take this wider perspective into account). So, while the designated boundary will probably have to remain coincident with the National Park boundary for the next several years, the "zone of cooperation" for program activities should, as a minimum, extend outward to encompass the resource systems of St. John's terrestrial and marine resource users.

Another potential approach for expanding to a fully functioning Reserve would be to seek cooperative arrangements with other governments within the region. For example, VIRMC already includes two members from the British Virgin Islands (BVI). In this instance, VIRMC could potentially serve as a mechanism for reserve expansion should the interest for participation in the program develop in the BVI.

At the regional workshop on "Biosphere Reserves and Other Protected Areas for Sustainable Development of Small Caribbean Islands" held on St. John in 1983, suggestions were put forward to create a biosphere reserve system in the Lesser Antillean region that would include a number of important areas that have already been identified (Wood, 1984). It was thought that such a system would facilitate increased cooperation in resource management in the region. The Caribbean Conservation Association was seen as the best vehicle for encouraging the creation and management of other biosphere reserves in the region, and a proposal to develop the concept was prepared by Unesco, but funding has not yet materialized. The potential for such a project still exists, however, and perhaps Unesco, VIRMC, the NPS, and the U.S. National Committee for MAB could play a catalytic role in generating the funding from bilateral or multilateral sources to expand the coverage of biosphere reserves in the Lesser Antilles. This could be particularly valuable to the VIBR if the strengths of the other reserves were complementary. Through effective arrangements for cooperation, each reserve could continue to focus on its strongest activities, and each benefit from the experiences of the other.

For example, it would appear that the greatest strength of the VIBR during the past two years has been in the areas of biological and geological research. Less progress has been made in integrated development or education

and training. Creation of reserves in other countries of the region where strong integrated development or education and training programs are already in place could potentially benefit the VIBR. This is the case of the Southeast Coast project in St. Lucia, sponsored by ECNAMP, which is a field program of the Caribbean Conservation Association, in cooperation with the Government of St. Lucia. Its greatest strengths are the integrated development, education and training aspects, and it in turn could benefit from the more advanced biological and geological research of the VIBR.

#### MANAGEMENT INFRASTRUCTURE

As presently structured, the only Biosphere Reserve management activities, separate from those of the National Park, are those which result as a spin-off of VIRMC research projects. NPS staff officially in charge of management are in a difficult position. They are by law charged with the management of the National Park according to standards set at the national level. They are at the same time made responsible for the management of the Biosphere Reserve according to concepts set at the international level. However, managers are not given the wider authority, management policies and guidelines, or additional trained staff to deal with the added objectives and larger area of a fully functional Biosphere Reserve. The job of managing the Biosphere Reserve is different, both in concept and in practice, from that of managing the National Park.

In the long term, successful management of a fully functioning Biosphere Reserve will require considerable cooperation at several levels. At the international and regional levels, this will involve collaboration on selecting priorities and methods, on coordinating activities and approaches for funding, and on the transfer of information and relevant experiences through a variety of channels. At the local level, resource users, government officers, researchers, educators, and administrators all need to contribute to decision-making if management is to address adequately their particular perspectives on people/environment relationships. To encourage the development of this "community-based management" approach, **Biosphere Reserve activities should provide the stimulus for close collaboration among these groups, and the establishment of functional links through the resolution of immediate resource issues and conflicts.** There is perhaps no better mechanism for doing this than the full involvement of these different groups in the development of a **Biosphere Reserve Management Plan.** The Plan would guide management of the VIBR program through the definition of objectives, boundaries, and zoning concepts; selection of priority projects for implementation of objectives; specification of staffing, budgetary, and administrative requirements; and identification of the most appropriate mechanisms for funding and for cooperation among managers, resource users, scientists, educators and politicians. This would seem to be the most basic step in the evolution of a fully functioning Reserve.

#### STAFF

Presently, the Park's Superintendent, Research Biologist, Resource Management Specialist, and Biological Technician; the VIRMC Contract Agent

(IRF); and the Park Service's MAB coordinator in Washington function as a kind of part-time staff of the Biosphere Reserve. The various VIRMC contractors augment this staff function to varying degrees depending on their understanding of, interest in, and commitment to, the overall VIBR Program, and the subject of their research. In order for the Biosphere Reserve to be fully functional, and a community-based management approach instituted, it would seem that **management policy, program, and priorities should be established by a management committee made up of the various elements of the community, including representatives of the relevant federal and territorial agencies.** The committee would have to work within the mandates of the federal and territorial agencies involved, the often conflicting requirements of the various elements of the community, and the physical and biological limits of the local ecosystems. The committee could probably occasionally draw on the staffs of the federal and territorial agencies. However, if the program is to be taken seriously, and if a true community-based approach to management is to be adopted, then the services of a very small but experienced and dedicated staff will eventually be required. A **program coordinator**, well versed on Biosphere Reserves and participatory approaches to management, would be needed as a minimum, and it would seem preferable for this position to be funded either through the U.S. National Committee for MAB, VIRMC, or the Reserve's Management Committee through grants. Such a coordinator would thus be relatively independent of the resource users and the institutions represented on the management committee. The management committee could perhaps evolve from a group constituted to develop the Biosphere Reserve Management Plan. Without this kind of independent structure, it is difficult to imagine that the objectives of the Biosphere Reserve Program can be achieved in any significant way.

#### FUNDING

Funding for the activities of the Virgin Islands Biosphere Reserve at present comes mainly through the NPS budget which supports the research carried out under VIRMC. Unesco and U.S. MAB funds were used to support the regional workshop on Biosphere Reserves held in 1983 and some of the costs for the production of a video about it. Each member of VIRMC who has been a subcontractor for elements of the Reserve Program has also contributed considerably, either through in-kind contributions, contributed time, or supplementary funding.

If the transition were made to a fully functioning Biosphere Reserve, then long-term funding for the services of a Reserve Coordinator would have to be located. The most logical source of funding for this purpose would seem to be the U.S. MAB Program, although a number of other territorial government (e.g., Planning Office or Department of Conservation and Cultural Affairs), federal government (e.g., National Park Service, Environmental Protection Agency), or foundation sources (e.g., World Wildlife Fund, Jackson Hole Preserve, Inc.) might be considered. These same sources might also be tapped for funding of specific projects in research, education, integrated development, or communications. In fact, one of the major functions of the Biosphere Reserve Program Coordinator might very well be the search for funding for individual priority projects, and coordination, control and evaluation of project implementation.

The VIBR program is a unique opportunity to demonstrate the benefits and mechanisms for cooperation in natural resource management, in the context of a U.S. Territory and an area located in a developing region of the world. Consequently, it is potentially of great interest as a vehicle for experimenting with community-based management approaches, and for cooperating in resource management within the Virgin Islands and in the Caribbean region. As such, it is of interest to private foundations which support innovative approaches to resource management, such as the Rockefeller Brothers Fund and the Conservation Foundation, and also to programs of regional cooperation. The concepts being developed for the creation of the Eastern Caribbean Center at the University of the Virgin Islands might have some potential in this regard. The Center's role to cooperate with Eastern Caribbean nations in educational, cultural, technical and scientific interchange would complement nicely the collaborative, practical demonstration, education and training aspects of the VIBR program.

#### A LESSER ANTILLEAN BIOSPHERE RESERVE SYSTEM

A system of biosphere reserves in the Lesser Antilles region potentially could be a useful mechanism for sharing technical expertise within the region and attracting resources from outside, but the dimensions of this potential are speculative at this point. If the transition to a fully functioning VIBR were accomplished, and natural resource managers from the region became familiar with the research, education, and demonstration services of the Reserve, then other islands may become interested in nominating their own areas for inclusion in a Lesser Antillean Biosphere Reserve System. Preliminary ideas on the areas that might eventually fit into such a system have been outlined (Putney, 1984) and discussed at the regional meeting on biosphere reserves held in St. John, 1983. However, given the relative newness of the program, and the greater human and financial resources available to the U.S. Virgin Islands compared with the small independent islands of the region, it seems reasonable to expect that the VIBR will have to demonstrate the benefits to be derived from the program before other countries will join the effort. Discussions on cooperative arrangements with the Government of the British Virgin Islands could be informally initiated through the VIRMC mechanism, since the BVI National Parks Trust and the Ministry of Natural Resources are members of the Cooperative. Outside of the U.S. and British Virgin Islands, expansion of the System might be more effective through the development of a regional project coordinated by a regional body such as the Caribbean Conservation Association, as recommended at the St. John meeting.

Scientists in the natural and physical sciences may tend to favor adding elements to a regional biosphere reserve system that would include ecosystems not presently included within the Virgin Islands Reserve, such as rain forest, cloud forest, limestone island, and deep ocean marine habitats. Social scientists and resource managers may be more interested in seeing link-ups established with projects that have greater experience with educational and integrated development objectives. Both of these aspects would be worth exploring in any move towards a multi-island Reserve System.

## STRATEGY FOR EVOLVING A FULLY FUNCTIONAL BIOSPHERE RESERVE

Perhaps the best way to summarize the concepts in this paper, and to recommend specific alternatives is to lay out a strategy for evolution to a fully functioning VIBR program. The strategy is laid out with respect to short-, medium-, and long-term actions. Because of the variety of unknowns involved, the strategy is necessarily general, especially concerning actions in the long-term.

### Short-term actions (years 1-3).

- VIRMC research projects continue with NPS and additional sources of funding, and are coordinated by the NPS Research Biologist in cooperation with the NPS regional resource management coordinator.
- Funding is sought to undertake special VIRMC projects to work with resource users to reduce negative impacts of heavy use of marine resources of northwestern bays, especially Cruz Bay.
- Source(s) of funding are located to hire a full-time Biosphere Reserve Coordinator.
- Negotiations are undertaken with the University of the Virgin Islands, or other VIRMC member, to provide an institutional base for the Coordinator.
- Coordinator seeks funding and coordinates implementation through VIRMC for model action projects designed to assist and guide development of the Coral Bay area in ways that are sensitive to both humans and nature.
- The British Virgin Islands declare Biosphere Reserve areas at Gorda Peak and Beef Island, and through VIRMC seek to coordinate management.
- Coordinator seeks funding for and coordinates development of a Biosphere Reserve Management Plan, including units in both the U.S. and British Virgin Islands. Participatory planning approaches that actively involve interested community groups and non-governmental organizations, relevant territorial and federal agencies, local scientific and academic institutions, and local politicians of the U.S. and British Virgin Islands are used.

### Medium-term actions (years 4-6).

- A Biosphere Reserve Management Committee evolves out of groups most active in the development of the Management Plan. Funding is found to support regular meetings of this Committee as part of VIRMC. The Coordinator supports the work of the Committee, and implements its recommendations as far as available funding or in-kind contributions permit.
- The Coordinator works closely with the Caribbean Conservation Association to identify funding so that the Association can work as a catalyst for expansion of the biosphere reserve system in the region.

- Two additional staff, a resource development specialist and an educational specialist, are assigned to the Biosphere Reserve Program, one by a territorial agency, and another by a federal agency. Arrangements are made with the institution supporting the Coordinator to support these two additional staff persons. The NPS Research Biologist continues to coordinate all Reserve research work.
- The educational officer raises funds for, and implements, a range of educational and training activities in cooperation with the governments, universities, and colleges of the Lesser Antilles.

#### Long-term actions (years 7-10).

- Additional Biosphere Reserves are set up in the Lesser Antilles under the coordination of the Caribbean Conservation Association. The Coordinator of the Virgin Islands Biosphere Reserve provides technical assistance on request.
- Exchange programs are set up with other Biosphere Reserves of the region so that technical expertise within the region can be shared.
- Educational activities with the Reserve consolidate around the presentation of a theory and field course each year on the management of island ecosystems. The course is run by the University of Virgin Islands, but through cooperative agreements, students from all of the region's universities and colleges are eligible to attend and receive credit. Arrangements are also made to facilitate the participation of civil servants from relevant departments of the governments of the Lesser Antilles.
- Training activities expand at all levels, including resource users and managers, teachers and students, and decision-makers. An annual international seminar is held on management of resources of small islands. It begins in the VIBR and then continues to the other Lesser Antillean Biosphere Reserves.
- Funding for the position of Biosphere Reserve Coordinator is provided on a regular basis through the U.S. MAB Program, the Eastern Caribbean Center of the University of the Virgin Islands, or some other source. The Biosphere Reserve Program becomes one of the main activities in the fields of resource and environmental management of the Eastern Caribbean Center.

#### CONCLUSION

In this paper, an attempt has been made to consider appropriate objectives for a Biosphere Reserve in the Virgin Islands, and to suggest ways that the Reserve could evolve to attain these objectives. While it is important to keep in mind the several ways that these objectives could be met, it is also useful to remember that the emphasis is on establishing a collaborative approach which makes management through consensus possible. Thus, the challenge seems to center around the building of positive working relationships through concrete accomplishments in solving resource management issues.

The promise of the Biosphere Reserve as a new resource management approach is great. The obstacles to fulfillment of that potential are also great. It is perhaps in the context of the Virgin Islands, a U.S. Territory in a region of small developing island nations, that the rich mix of cultural diversity, new ideas, diverse tropical ecosystems, and a commitment to programs of regional importance can provide the ingredients to attain the full potential of the Biosphere Reserve.

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