VIRGIN ISLANDS RESEARCH NEEDS CONFERENCE

April 24, 1973

P R O C E E D I N G S

CARIBBEAN RESEARCH INSTITUTE
COLLEGE OF THE VIRGIN ISLANDS
ST. THOMAS, VIRGIN ISLANDS 00801

THE CARIBBEAN RESEARCH INSTITUTE

The Institute is a division of the College and was established in 1965 to provide a central research agency in the Virgin Islands and to encourage research in the Caribbean basin. It pursues a broad spectrum of investigation in the natural, physical and social sciences. All investigations of the Institute and its staff, the findings, data reports and publications, are made available to the public.

The research policy of the Institute is one which seeks relevance to local needs and problems, one which seeks to derive a broader base of knowledge about insular environments from a case study approach, and which seeks to relate its specific work on islands to that of the larger scientific community. It is seeking a balanced perspective of the particular and the general, the archetypal model and the replica, the rule and the exception, the human community and the insular environment, and is attempting to make regular use of the cybernetic feedback principle (both negative and positive) between the diverse perspectives of the scientist and the decision-maker, between the world of abstract theory and the changing environment, between the search for scientific principles and the search for solutions to contemporary problems.

COLLEGE OF THE VIRGIN ISLANDS

CARIBBEAN RESEARCH INSTITUTE

Lawrence C. Wanlass, Ph.D.	President of the College
Arthur A. Richards, Ed.D.	Provost and Dean
Norwell Harrigan, M.B.E., Ph.D.	Director, C.R.I.
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Beverly Bandler	Projects Assistant
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Dr. Norwell Harrigan	Chairman
Mr. Eustace Arrindell	Student Council, C.V.I.
Miss Enid Baa	V.I. Bureau of Libraries & Museums
Miss Beverly Bandler	C.R.I.
Miss Ilva Benjamin	Nursing Division, C.V.I.
Mr. Eric Blake	Social Sciences Division, C.V.I.
Mr. O. Marcus Buchanan	V.I.E.R.S., C.R.I.
Dr. Aimery Caron	Administration, C.V.I.
Dr. Ernest Fickas	St. Croix Campus, C.V.I.
Miss Doreen Hector	Humanities Division, C.V.I.
Dr. William MacLean	Science & Mathematics Division, C.V.I.
Mr. Peter Rasmussen	V.I. Department of Education
Dr. Fenton Sands	Agricultural Extension Service, C.V.I.
Mr. John Tinsley	Business Administration & Con-Continuing Education
Miss Pearl Varlack	Education Division, C.V.I.
Mrs. Artrelle Wheatley	Student Affairs Research, C.V.I.

CONTENTS

FOREWARD

Conferences, even under the most ideal conditions, are notoriously difficult to organize. With the lack of experience in the field and a small staff we had our fair share of problems.

We are glad, however, to be able to record that the administration, the business office, the research-oriented faculty members, maintenance and the cafeteria all gave the Institute full cooperation and we wish to express our gratitude for what was in effect College-wide support. Special thanks are due to the Research Liaison Committee who undertook the planning of this important first effort.

Our participants included a cross-section of the Virgin Islands communities on all three islands. This expression of public support was an inspiration and greatly appreciated.

The conference recommendations can be regarded as merely a listing of possible research areas. Little more could be expected from a one-day session. It will now be necessary to discuss these ideas in depth, to evaluate them and prepare on the basis of this evaluation concrete proposals for research action. Committees are being established for this purpose. The College and the Institute will then, hopefully, move forward in the furtherance of its mission by tackling some of the problems which need to be investigated.

THE RESEARCH NEEDS CONFERENCE - AN OVERVIEW

In his opening remarks Dr. Norwell Harrigan, the acting director of the Caribbean Research Institute (CRI), drew attention to the fact that the Institute was evidence of the recognition by the College of the Virgin Islands of its duty to investigate its own environment and whatever might be thought of its activities, it had made a contribution to the life of the Virgin Islands which could be viewed with some degree of satisfaction and pride.

The conference was an indication that the Institute did not propose to remain static, rather it intended to reevaluate its policies, review its programs, ask (and if possible, answer) other questions, blaze new trails, and instead of confronting 'needs' that are directed by resources to undertake to search for resources to meet determined needs. He concluded by saying, "If this conference had an explicit theme it would be, 'what kind of society have we really got, where is it going, and what are we going to do about it.'"

Approximately 50 persons representing the College and the community responded to the invitation to join in the quest for solutions by examining what research had been done in the Virgin Islands, attempting to determine what research needs to be done and to ascertain what resources were available to do the necessary research.

Four research status papers were presented at the plenary session. The first summarized the objectives and results of research undertaken by the Institute from its inception in 1966 through 1972. Officially, there have been 56 CRI projects, a few of which were in support of conferences, symposiums, or publications, but the bulk of which covered research in the arts, biotoxicology, conservation, education, hydro-geology, marine archaeology, marine resources, remote sensing technology, socio-economics and water quality. Of the total number of projects, the majority have focused on the marine/water resources field. It is estimated that some 60 reports

were produced during the above referred period with 20 of these on water quality control, and the balance fairly evenly divided between conservation, fisheries, the physical and natural sciences, and social sciences.

The paper on ecology provided a general introductory background theme to the topic of ecological research, using the term "ecology" as the study of the relationships of plants and animals to one another and to their environment. It pointed to the anomalous status of the Virgin Islands with regard to ecological research endemically-generated, putting the Virgin Islands "distinctly behind their other West Indian neighbors in ecological awareness." Most applied as well as basic ecological research prior to the early 1960's was conducted by "commuter scientists, with the current interest based mainly on the establishment of the Virgin Islands National Park, the College of the Virgin Islands, and the Bureau of Fish and Wildlife of the Department of Conservation and Cultural Affairs.

The third paper reviewed research in the Virgin Islands and the Caribbean as a whole and revealed an "exceedingly small volume of(masters and doctoral)studies produced to date" concerning the Virgin Islands (38 of a total of 1,248). The list breaks down into the following disciplines: Art and Music (1); Biography (1); Economics (1); Education (4); History (6); Linguistics (1); Medicine and Health (4); Natural Sciences (2); Politics and Government (9); Social Sciences (9). A crucial factor, it noted, is how much in the way of official records and documentation has been lost through poor administrative procedures and indifference.

The paper on education research tells a similar story when it states that "it is a curious irony that neighboring Puerto Rico has been analyzed in almost every imaginable area by researchers, while the Virgin Islands has been significantly neglected." The paper lists 40 studies on education done since 1928, 21 of which were done in the 1960's. This decade has

resulted in 12 efforts to date. The paper makes 7 recommendations for immediate needs, and comments on resources available to accomplish the research.

Following the plenary session, the participants broke up into four study groups - Water and Ecological Research, Social Research, Economic Research and Education. Recommendations and a summary of the discussion of each group are separately contained in this report.

In a second plenary session reports from each group were submitted. In these and the discussion that followed there were certain threads that could be said to have run through the conference as a whole. There was general agreement about a failure both to define and conduct research (one comment was that a state had been reached where looking for a word in the dictionnary was called research). The compiling of data in all areas was erratic at best, not comprehensive and what little had been gathered was not readily available. The result was that actual knowledge was extremely limited, and where available was not disseminated.

A second point of general agreement was the lack of communication, not only among people in different disciplines, but also among those in the same or similar disciplines. This has led to a duplication of effort which is wasteful of the limited resources available.

Comprehensive planning in all areas and integrated planning was seen as an urgent need in which research had a significant part to play.

If one attempted to state in brief the consensus of the discussions, it would perhaps be that we are not adequately prepared to deal with the complex challenges and changes in the Virgin Islands today, and that something is wrong with our communities and it is time that we assess it.

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LIST OF PARTICIPANTS

1. Mr. Eustace Arrindell, President, C.V.I. Student Coucil
2. Miss Enid Baa, Director, Division of Libraries & Museums, V.I. Department of Conservation & Cultural Affairs
3. Miss Beverly Bandler, C.R.I., C.V.I.
4. Mr. Eric Blake, Social Sciences Division, C.V.I.
5. Mr. Thomas Blake, V.I. Planning Office
6. Mr. O. Marcus Buchanan, V.I.E.R.S., C.R.I., C.V.I.
7. Mr. Louis O. Brown, Economic Opportunity Office of Community Services, St. Croix
8. Mrs. Marva S. Browne, Citizens Committee
9. Dr. Aimery Caron, Administration, C.V.I.
10. Mr. Vincent A. Colianni, St. Croix Chamber of Commerce
11. Dr. John Cross, Social Sciences Division, C.V.I.
12. Dr. Arthur A. Dammann, Bureau of Fisheries & Wildlife, Department of Conservation & Cultural Affairs
13. Dr. Burt Dunmire, Continuing Education Division, C.V.I.
14. Dr. Ernest Ftckas, St. Croix Campus, C.V.I.
15. Mr. Pedrito Francois, Division of Environmental Health, V.I. Department of Health
16. Dr. Francis M. Grant, Education Division, C.V.I.
17. Dr. Harold Haizlip, V.I. Department of Education
18. Dr. Norwell Harrigan, C.R.I.
19. Miss Doreen Hector, Humanities Division, C.V.I.
20. Dr. Michael Hench, Humanities Division, C.V.I.
21. Mr. Valdemar Hill, Sr., Publisher
22. Mr. Valdemar Hill, Jr., Business Administration Division, C.V.I.
Reverent K. R. Khan, Special Assistant to the Governor
24. Mr. Jean Larsen, V.I. Department of Labor, St. Croix
25. Mr. Romeo Malone, Savan Development Committee
26. Mr. Euan P. McFarlane, St. Croix
27. Dr. William MacLean, Science & Mathematics Division, C.V.I.
28. Mr. Bart Montiegel, V.I. Water & Power Authority
29. Dr. A. R. Mora, Social Sciences
30. Mr. Bruno Neumann, V.I. Budget Office
31. Mr. Darwin Newton, Student, C.V.I.
32. Dr. John C. Ogden West Indies Laboratory, St. Croix
33. Mr. Michael O'Neal, Research & Consulting Services, Tortola, B.V.I.
34. Mr. Peter Rasmussen, V.I. Department of Education
35. Mr. Alan Robinson, U.S. National Park Service
36. Mr. David Rossington, Student, C.V.I.
37. Mrs. Hortense M. Rowe, Department of Conservation & Cultural Affairs
38. Mrs. Eldra Shulterbrandt, Division of Mental Health, V.I. Department of Health

(List of Participants, Cont.)

39. Mrs. Esther Smith, C.R.I.
40. Mr. James Spain, V.I. Teachers Union
41. Mr. Robert Stanton, U.S. National Park Service
42. Mr. Melvin Stevens, V.I. Department of Labor
43. Mr. John F. Tinsley, Business Administration, C.V.I.
44. Dr. Edward L. Towle, Island Resources Foundation
45. Mr. Robert P. vanEepoel, Insular Environments, Inc.
46. Miss Pearl Varlack, Education Division, C.V.I.
47. Mrs. Vitalia Wallace, Associate Dean, C.V.I.
48. Mrs. Artrelle Wheatley, Institutional Research, C.V.I.

AGENDA

8:30 A.M. **Registration**
Theater, College of the Virgin Islands

9:00 A.M. **Plenary Session**

Chairman.....Professor Vitalia Wallace
Associate Dean, C.V.I.

Opening Remarks.....Dr. Norwell Harrigan
Acting Director, C.R.I. &
Chairman, Research Liaison
Committee

Research Status Papers

C.R.I. Research.....Miss Beverly Bandler
Projects Assistant, C.R.I.

V.I.E.R.S. Research..Mr. O. Marcus Buchanan
Director, V.I.E.R.S.

Education Research...Mr. Peter Rasmussen
Director, Division of Planning,
Research & Evaluation
Department of Education

General Research.....Miss Enid M. Baa
Director, Libraries & Museums
Department of Conservation &
Cultural Affairs

10:45 A.M. **Break**

11:00 A.M. **Discussion Groups**

Water & Ecological Research — Room 319

Discussion Leader: Dr. Ernest D. Fickas, Jr.
Rapporteur: Dr. William MacLean

Social Research — Room 310

Discussion Leader: Mr. Michael O'Neal
Rapporteur: Mr. Eric Blake

Economic Research — Room 302

Discussion Leader: Professor John Tinsley
Rapporteur: Mrs. Artrelle Wheatley

Educational Research — Theater

Discussion Leader: Mr. Phillip A. Gerard
Rapporteur: Professor Pearl Varlack

(Cont.)

(Agenda, Cont.)

12:30 P.M. Lunch

1:30 P.M. Discussion Groups (Resumption)

3:00 P.M. Plenary Session

Chairman.....Dr. Burt Dunmire
Dean, Continuing Education,
C.V.I.

Presentation of Discussion
Group Reports.....Rapporteurs

Vote of Thanks..... Dr. Norwell Harrigan

4:30 P.M. Conference Ends

WATER & ECOLOGICAL RESEARCH

RECOMMENDATIONS

1. The circulation of information on the status of current research and research proposals.

2. The tabulation and circulation of the research needs listed in research and consultant reports already done.

3. The initiation of comprehensive planning and an effort to effect a mechanism and atmosphere which encourages wider input in the decision-making process and more diverse approaches to relevant problems.

4. Urgent attention to water and power planning with special emphasis given to alternate sources.

5. The exploration of the possibility of utilizing solar energy to meet the energy needs of the islands.

6. The commitment of the Government to implementing and enforcing legislation which results from environmental research.

7. An ecological study of marine life.

8. A survey of all current and projected sand resource needs.

9. An analysis of beach and coastline erosion.

10. Further studies on Ciguatera toxin to include an epidemiological survey in the Virgin Islands (both British and U.S.), a chemistry program to identify toxic fish, and an ecological program to identify the food chain and toxic fish species.

11. The organization of a Virgin Islands Natural Science Conference Group.

SUMMARY OF DISCUSSION

The West Indies Laboratory of Fairleigh Dickinson University on St. Croix, the National Park Service, the Departments of Conservation and Cultural Affairs and Health (Division of Environmental Health), Island Resources Foundation, Insular Environments, Inc. (a private consulting firm), and the College of the Virgin Islands through its Math & Science Division, Caribbean Research Institute and the latter's subdivision, the Virgin Islands Ecological Research Station (VIERS), are all engaged in water/ecological investigations and were represented at the Conference.

Much of the time of the study group was devoted to an exchange of information regarding the functions and responsibilities of the various bodies represented, but some problems were noted. These included a lack of communication about research and among researchers (eight of ten participants were directly involved in these areas, yet few of them were known to one another); the long heritage of inefficient consulting; little or no guidance given to research other than that dictated by available funding; resistance to overall planning by the local government (planning takes a backseat to expediency and is ignored as a framework in which research should be accomplished); the lack of easily accessible publications with useful data and findings; and the inability of the Government to enforce current environmental legislation due to the lack of personnel.

Botany

A study is currently being done to determine the quantity or recoverable protein produced in coconuts and the methods of economically recovering such protein. This investigation is a USAID funded project in which partial field work is being carried out on St. John (VIERS). A survey on certain floristic components of St. John continues at VIERS (a herbarium is on site). A study of the pollinators of a conspicuous component of Virgin Islands flora, the *Agave* or century plant, was initiated on St. John

but was discontinued due to a lack of funding.

Ecology

Ecological studies have been done and are currently being pursued on frogs, lizards, ants, fiddler crabs, sponges, West Indian Topshells, ostracods [at VIERS], deer herds, doves, bats and the mongoose [Department of Conservation & Cultural Affairs]. Tree frog communities have been studied on St. John, St. Croix, St. Thomas, Tortola, Virgin Gorda, Anegada, Vieques, and Puerto Rico. The latter studies re-examine the species' relationships with specific emphasis on population dynamics, isolating mechanisms, niche structure and food habits. Indian and South American lizards are currently being studied by a member of the CVI science faculty to examine causes of change in populations, which has theoretical significance in evolutionary biology and is also important in plant and wildlife management. A list of insect species on St. John is available and a field guide to the natural history of Puerto Rico and the Virgin Islands is in progress [Department of Conservation and Cultural Affairs].

The Department of Conservation & Cultural Affairs is also preparing an atlas of offshore cays and their usage potentials, and a member of the CVI science faculty is hoping to use Sail Rock as an ecological experimental area. Coral reef ecology is a major interest of the West Indies Laboratory. A survey of bat fauna is underway at VIERS, and is concerned primarily with the reproduction of economically and aesthetically important plants in the Virgin Islands. A projected study at VIERS is on the nitrogen cycles in tropical soils subjected to slash and burn agriculture, with special attention to the role of termites.

Hydro-geology

A reconnaissance survey of the shallow shelf area south of St. Thomas and St. John to prospect sand offshore and to describe and chart offshore

deposits of sand suitable to be mined for making concrete landfill and beach replenishment has been made [CRI]. In the spring of 1970 sediment core samples were collected [Ocean Survey Program of Tektite II] which underwent textural and mineralogical analysis to determine the patterns of sediment distribution, and a bathymetric map was made describing the bottom position, sub-bottom structure and geophysics of the Virgin Islands platform south of the two islands, with a resulting report with three sites for exploitation discovered. CRI was unsuccessful in effecting a long-term marine geology program or feasibility investigations with regard to sites already located for exploitation south of St. Thomas. The West Indies Laboratory has also been unsuccessful in obtaining funding for a sand resources study.

Data has also been collected and a sea bottom survey made [CRI] to study the oceanographic, geophysical, meteorological and hazard factors for a possible route for a submarine cable for transmitting electric power between St. Thomas and St. Croix. The degree of correlation between the well-marked ecological zonation of coral reefs and reflected structure of reef-derived inshore sediments is currently under study [VIERS].

Marine Archaeology

The main efforts of the Marine Archaeology Program of CRI which was initiated at the end of 1969 have been directed to an inventory and assessment of marine archaeological resources in the Virgin Islands. This inventory, along with a register of historic underwater sites, will be available in the fall of 1973 together with inventories of artifacts found from two Virgin Islands wrecksites, the HMS Nymph (1783, Tortola) and the HMS Santa Monica (1782, St. John).

Marine Resources

The basic Virgin Islands fisheries studies were done at CRI/VIERS and covered a 3-year period. The purpose of the program was to investigate the

fisheries potential of the Virgin Islands. The studies indicated that the local shelf area available for fishing is only about 2,000 square miles and that while a bewildering array of species were discovered, each species is represented in comparatively small numbers. Deep water snapper fishing holds the only commercial promise.

The fish with the greatest commercial potential is the silk snapper, a fish abundant in water from 60-150 fathoms. Three productive areas for this fish were located. Indications are that this fish would support a sizeable native fishery with small boats in the 22-36 feet range. The investigations concluded, however,that while deep-water snapper fishing held promise, there could be little progress towards the development of Virgin Islands fisheries until the effect of ciguatera toxin is better understood. Little is known about the chemistry, pharmacology and ecology of ciguatoxin.

A preliminary study of ciguatera fish poisoning was made over a one-year period [CRI/VIERS]. Completed in June of 1972, it established a facility for screening bioassays on a large volume of fish samples and a reporting system to obtain data on incidence of fish poisoning. Experimental bioassay/chemical extraction methods were effected. According to the study, there is good evidence that the shelf-edge stocks of snapper and grouper are not free from ciguatera poisoning as previously presumed, and that exploitation of this presently underutilized resource may be impeded by this toxicity. This study has been discontinued.

Work on fisheries is currently being pursued by the Department of Conservation & Cultural Affairs through its Fish and Wildlife Bureau. The bureau has completed a 5-year development program for fisheries, and its current project includes: fisheries life history studies, studies on the utilization and improvement of native fishing boats, the construction of two experimental artificial reefs, and a fresh water recreational fishing

pond on St. Croix.

Fisheries research has also concluded that there are eight species which hold promise for future mariculture projects: turtle, conch, squid, mangrove oyster, spiny lobster, whelks, octopus, and several species of crabs. CRI investigations were done on St. John in 1970-71 on the spiny lobster (Panulirus argus) and data were gathered for the purpose of defining the population, ecology and behavior and vital statistics. Investigations indicate that approximately 17,000 lobsters are around St. John in the 10 fathom curve on any given day. The West Indies Laboratory is currently working on mariculture projects.

Water Quality

CRI began conducting water pollution studies for the Virgin Islands Government during the summer of 1969. Upon its termination in October of 1972, the project had produced twenty reports covering enclosed bays, two harbors and sewage disposal practices and operating efficiencies of package sewage treatment plants. The most comprehensive data gathered were on Christiansted Harbor. Investigations done for the Harvey Alumina plant described and delineated the thermal plume and marine benthic communities in the plant area on the south shore of St. Croix. The College is currently looking for a director for the Water Resources Research Center. According to one College representative, the water laboratory will be mostly concerned with potable water problems and will also address itself to sewage disposal and its affects on coastal waters.

Field studies have been conducted on St. John concerning the degree of correlation between the well-marked ecological zonation of coral reefs and the structure of reef-derived inshore sediments [VIERS]. The West Indies Laboratory has a strong interest in environmental monitoring.

Energy Sources

One conference participant is currently working on a proposal on surface reflectivity of water with the idea of utilizing solar energy.

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SOCIAL RESEARCH

RECOMMENDATIONS

1. A comprehensive study of multi-culturalism in the Virgin Islands including an analysis of each ethnic group, their attitudes and values.

2. A study of the family structure of the native Virgin Islander, including comparison with the nuclear family structure of other ethnic groups and the social implications.

3. A study of urbanization in the Virgin Islands to attempt to determine the effects of population growth on social and economic mores of the community.

4. A study of V.I. housing projects to determine inter alia the social factors involved in current approaches.

5. A comparative study of three small communities: (e.g. Savan, Bovoni, and Frenchtown).

6. A comparative study of St. Croix, St. John and St. Thomas as an attempt to determine socio-economic differences and the reasons therefor.

7. An examination of the nature of polarization in the Virgin Islands.

8. An examination of the role of the individual in the Virgin Islands' decision-making process.

9. Compilation of a list of typical social research topics, and the selection and assignment of priorities to those pertinent to Virgin Islands needs.

10. An outreach program into the community, such as meeting and talking with groups like the Savan Development Organization, with a view to investigating how suggestions obtained can be utilized.

11. An effort to arrive at a workable consensus about Virgin Islands "culture."

12. A study of the political and administrative systems.

13. A study of the sociological implications of tourism, particularly the attitudes of indigenous people to the industry.

SUMMARY OF DISCUSSION

The fourteen participants in the study group were faced with a dilemma, with many questions posed: Who are the people of the Virgin Islands? What is Virgin Islands culture? Shouldn't a society know and understand itself before deciding where to go?

The initial discussion centered around philosophical views on social methodology and the kinds of findings that are obtained as a result. This lead into social research in the Virgin Islands and the problems confronted. The general agreement was that the basic problem is that the Virgin Islands does not understand the nature of its society. Not only is it impossible to give relevant answers, but the confusion and haze which has enveloped the society often makes it difficult to ask the right questions.

The discussion then took the form of a group attempting to clear its own collective mind. What does a community need to know? It needs to know what it is - what peoples live within in, and where. The values, motivations and social structures of these peoples. The nature of their interaction with each other and as a community, and why. How the interaction affects the life of the community. Whether it is selecting models that promote a healthy environment, models that are suitable to the society.

The varied and complex nature of Virgin Islands society was appreciated, but it was agreed that a society so rich in variety of people and cultures, and small enough to be manageable, was a virtual laboratory for multi-cultural studies. That so little research has been done is a loss both to the Virgin Islands and to social research as a whole.

It was also agreed that as a community under stress due to rapid social, economic and physical changes, there was an urgent need for

social exploration which would establish a base for decision making capable of promoting the welfare of both present and future Virgin Islanders. While the importance of the behavioral sciences have been vastly underrated by the world at large, failure to pursue such investigations in our society may have serious consequences for our islands.

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ECONOMIC RESEARCH

RECOMMENDATIONS

1. A local population census prior to 1980.

2. An income survey to determine individual family and territorial income.

3. A manpower study to determine the total and nature of available manpower and employed manpower.

4. A study to determine what the Virgin Islands imports and exports, how much, and from and to whom.

5. An analysis of Virgin Islands capital needs and availability data.

6. Establishment of long-range economic goals, consistent with an overall physical, economic and social plan for the Virgin Islands.

7. Establishment of an Economics Research Committee to make use of a substantial number of under utilized people with the Virgin Islands who have expertise in economics.

8. The establishment of a central source of economic information (e.g. an Economic Information Data Bank) within the Virgin Islands Planning Office.

9. The designation of the Public Library as a legal central depository for all Virgin Islands Government documents.

10. An analysis of curriculum at the high school and college levels as related to economic and social goals.

11. A study of the Tax Incentive Program to determine cost/benefit ratio.

12. A preliminary study to investigate diversification of the economy, to result in a list of possible alternatives.

13. Tourism study or studies which should include cost/benefit analyses.

SUMMARY OF DISCUSSION

Decision-making on the Virgin Islands economy requires an understanding of how the economy works. In the view of the study group on economics, the Virgin Islands does not understand its economy. Basic data, standards by which an economy can be measured and access to this information, economic policies set in relation to overall long-range comprehensive goals for the islands, mechanisms set up to implement these policies -- all were seen as badly needed. With so much interest in the economy vis a vis the media, political sphere and business community, it is amazing that there is but one thesis on economics noted in Background Paper No. 3 (Appendix IV).

Basic Data

It is the general consensus that the Virgin Islands is at "ground zero" in terms of reliable economic information. While in some areas fairly reliable data exists -- revenue and expenditures, import and export figures, school enrollment data by island and age groupings, some housing statistics -- the usual economic indicators do not exist. There is no information on Gross Territorial Product, National Income, Personal Income, Cost of Living, Prices, and Capital Needs.

The most serious problem is caused by the reputed inaccuracies of the 1970 U.S. Census which indicates that there is a total population of 62,468. The census figures are strongly disputed, and estimates of the total population of the islands have gone as high as 100,000. The analysis of most data will be meaningless if an inaccurate population count faults all other statistics, and lack of such basic data certainly makes physical, social and economic planning almost impossible. A prime example of the difficulties caused is a per capita income figure for the Virgin Islands that is 25% higher than the United States.

Manpower Data

What is the manpower situation and the needs of the islands? As has been pointed out in the progress reports of the committee for the Overall Economic Development Plan (OEDP), it is not known how many people in the Virgin Islands are employed, unemployed, or underemployed. There is no comparability among employment statistics based on the census, those developed by the Employment Security Agency or the V.I. Department of Labor. While raw data does exist in the Department of Finance that can be useful (plus much more information on income statistics--individual, family, territorial), accurate population figures are required for correlation.

Access to Information

The study group reconfirmed another serious problem affecting economic research and decision-making in the Virgin Islands: the lack of access to information. There is at present no central source for obtaining information. Although the Public Library is supposed to serve as a depository official depository for Government reports, this policy has not been effected. It is also the general opinion that many V.I. Government departments are reluctant to release information which they interpret as that which would reflect badly on the work of the particular department. Departmental personnel are reluctant to provide access even to published materials. It has been noted that much of the published material is out of date even before publication.

In addition to the legal designation of the Public Library as a Virgin Islands Government depository, it was considered that: (1) the Budget Office should maintain a general coordinating surveillance of studies or surveys made for departments and agencies of the V.I. Government by private consultants, research or education institutions, and agencies of the Federal Government, and it should maintain a complete file of such reports and surveys as recommended by the "Hubbard Report"; (2) Basic

data should be gathered and maintained in one central source, with the recommendation that the most appropriate place for such is the V.I. Planning Office (the creation of an Economic Information Data Bank was indicated).

The starting place is an economic base study. The Virgin Islands is probably the only area under the U.S. flag which has never undertaken such a study. Until there is comprehensive and reliable data, no reasonable decisions on or plans for the Virgin Islands economy can be made.

Planning

The group concluded that planning has never held a high priority in the Virgin Islands Government. While the administrative mechanism for coordinated comprehensive planning has been set up since 1950--the V.I. Planning Board between 1950-70, and the V.I. Planning Office from 1970--there has been only limited short-range planning, strictly physically oriented, with little if any coordination. In short, Virgin Islands planning legislation of some 23 years duration has never been implemented as intended. The decade of the 70's is demonstrating the bitter fruits of uncontrolled and unplanned growth. It was the consensus of the participants that this approach to growth and development must terminate.

Diversification

The group demonsrated that there are differences of opinion as to the question of diversification of the economic base and the lessening of a reliance on tourism. It was pointed out that the lack of manpower, utilities, and the possible change in the Federal Government's "301 Program" provisions, limit our potential. Once again, basic information is needed. What are the cost/benefits of tourism? What are the cost/benefits of the Tax Incentive Program? What are our alternatives?

The group suggested that the College take on a strong leadership ro role in this area, and recommended that CVI students play an active role in any mechanism established which would deal in economic research. research. It was also recommended that an appropriate vehicle or group be organized to direct a well-ordered group of economic projects.

#

EDUCATIONAL RESEARCH

RECOMMENDATIONS

1. A study of the role of education in the value system of the Virgin Islands: (a) the student, (b) the teacher, (c) the parent, (d) the general public.

2. A comprehensive study of the socio-economic factors affecting the learning process of V.I. school children including home/family factors, multi-culturalism, children's relationship to community, and their implications.

3. A study of the Parent/Teacher Associations throughout the Virgin Islands: structure, organization, attitudes, and effectiveness.

4. An analysis of job/higher education placement for all Virgin Islands public school children for the last five-year period.

5. A survey of manpower needs.

6. A survey of skills needed in the Virgin Islands looking towards an examination of vocational education programs.

7. The development of a Handbook of Virgin Islands Usage for entering teachers in Virgin Islands public schools.

8. A study of the effects on learning of multi-culturalism and linguistics.

9. A study of student self-concept and attitudes.

10. A survey to form the basis of recommendations for a Teacher Training Program to include professional teachers and in-service education, new teachers, undergraduate teachers.

11. A study to determine the advisability of a para-professional program in the public school system.

12. A study to determine in which academic areas public school children in V.I. are most successful and why.

13. A study of adult education in the Virgin Islands.

14. A comparative study between island and stateside education models from kindergarden through 12 grade.

SUMMARY OF DISCUSSION

The role of learning, said the late ecumenical rabbi Abraham Joshua Heschel, is a "source of inspiration, the greatest adventure, a source of joy." Suffice it to say that in the Virgin Islands it has been "the greatest adventure" to attempt to keep up with the constantly increasing growth of public school enrollment which consistently outdistances the provision for facilities.

The conference study group on education conducted a wide-ranging discussion, which included commentary on the extreme pressure felt by the education system due to the incredible and unplanned growth rate. This growth has been a real obstacle in assessment of the total system as it relates to the community as a whole, inspite of financial support that amounts to some $28 million, or close to $1,300 per child per year. It is not known how successful the system has been, where the graduates are now, what the cost/benefit ratio is, and whether the students not only have the skills for employment, but the tools for adulthood. The main points of discussion were the following:

Manpower Needs

A survey on manpower needs was reportedly done some years ago, but what is required is current knowledge on community needs so that public school curricula can be so oriented as to fill these needs.

Vocational Education

A survey of skills needed in the various communities is essential with a view towards an examination of current programs and the establishment and funding of such other programs as might be necessary.

Handbook of Virgin Islands Usage

Large numbers of teachers from the continental United States are recruited annually to fill vacancies on public school staffs. These

teachers encounter much difficulty in communicating with and comprehending satisfactorily the average public school child. Much of the lack of communication is caused by differences in the usage of English by persons from the various geographical and cultural areas. Since this difficulty sets limits on the abilities of teachers to meet the needs of local children, some method should be devised to counteract it. The development of a handbook or dictionnary of Virgin Islands English Usage, made available to non-Virgin Islanders taking up employment in the public schools, should assist in remedying the situation.

The Effects on Learning of Multi-culturalism and Linguistics

It may be that the achievement of local children is correlated in one way or another with the diversity of cultures and language usage to be found among members of the public school community. How far this diversity affects learning and school achievement, testing and grading, etc. is a matter of some concern to local education authorities and warrants some investigation. Closely related to this are the effects of teacher training, and standardized tests.

A survey of this sort is envisioned as a multi-year project requiring the professional services of persons competent in cultural anthropology, psycho-linguistics, curriculum, and educational research. Some contributions from mental health practitioners would also be required.

Student Self-concept and Attitudes

There is a need for an understanding of both the attitudes and self-concept of the students who indeed represent different backgrounds and are the products of different school systems.

Teacher Training Program

An examination of the conditions which would affect the teacher education program of the College of the Virgin Islands in terms of its

meeting the existing needs of the school system was suggested. There would be three aspects to this viz.:

(a) Professional teachers and in-service education;

(b) New teachers: it was wondered whether a pre-service program in the form of a week-long seminar as orientation for in-coming teachers to the system, particularly for those recruited outside of the Virgin Islands, would not substantially help;

(c) Undergraduate students: the undergraduate program should be look at in terms of improvement and acceleration of its contribution to public education from the points of view of duration of training and relevant curriculum models.

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APPENDIX I

Address By
Norwell Harrigan, Ph.D.
Acting Director
Caribbean Research Institute
To Research Needs Conference

Tuesday, April 24, 1973

ADDRESS BY
NORWELL HARRIGAN, PH. D.
ACTING DIRECTOR
CARIBBEAN RESEARCH INSTITUTE
TO RESEARCH NEEDS CONFERENCE

Tuesday, April 24, 1973

* * * * *

Dean Wallace (I address you thus because I omitted to clear with you if you had any objections to the term "madam Chairman", and I take strong personal exception to the bastardized expression "chairperson"), Ladies and Gentlemen, A week ago so few people had indicated an interest in our conference that we were becoming apprehensive, now I can say in all sincerity, "I am glad to see so many of you here!"

The most amazing story that has come to me in connection with this conference concerns a person who expressed bewilderment as to why certain other persons should be involved in any way about research. Although I have come across this attitude in other places and in high places, it came as somewhat of a surprise to me in the United States Virgin Islands (although it perhaps should not have done). Here we have the advantage of our own institution of higher education (and the extension of the boundaries of knowledge in addition to increasing knowledge and disseminating knowledge is a primary function of higher education) which very early in its young life recognized its

duty to investigate its own environment. In retrospect it could perhaps be argued that we set our sights too high and that we have moved in questionable directions. Our image may have been seen differently by different publics; while some regarded the work as successful and stimulating, others considered that it had failed in its primary functions. However that may be and from whichever side of the fence one views the scene, I think all reasonable people must agree that given our situation and circumstances, the college has already through its research made a contribution to the life of the Virgin Islands which can be looked upon with some degree of satisfaction and pride.

Today's conference is an indication of the fact that in the discharge of the duty to investigate our own environment we do not propose to be static. In every organization there comes a time of evaluation when policies and programs must be reviewed; when other questions must be asked and (if possible) answered; when new trails must be blazed. We believe that for us that time has come and we want to meet the challenge. But we also believe that rather than confronting "needs" that are dictated by resources we should undertake to search for resources to meet felt needs. It is towards this end that we have asked you, Ladies and Gentlemen, community leaders who confront the problems of these societies with every decision (or lack of it) every day, to participate in the conference. In the discussion of the multifarious problems we may, hopefully, arrive at some concensus as to which ones need new approaches based on investigation at the local level.

Up to this point I think I can safely claim to speak for the college's Research Liaison Committee. This consists of members of the Research Institute's staff, of each teaching division, the Agricultural Extension Service, and a representative of the Bureau of Libraries and the Department of Education on whose shoulders will fall the task of assisting in the determination of future directions. What I shall now say are views which I hold as a result of personal experience in high office in a not dissimilar society and which to some extent have guided and will guide my approach to the leadership of the Research Institute during my tenure.

I cannot see how one can reasonably argue with the proposition that we are beset by intractable problems in these islands. We have them catalogued by various sources almost daily. What in my view is open to argument are the proposed solutions which are based more often than not on conventional wisdom, the "emulation syndrome" (which I submit is a basic characteristic of our societies) - or worse still, the "hat trick" in which the rabbit appears from nowhere. Seldom indeed are "solutions" based on a thorough understanding of the situation obtained from proper investigation by persons capable of interpreting the relevance of the data (as distinct, I insist, from the academic and professional horsemen who gallop through the area with ready-made solutions for every conceivable problem). There is only the certainty that after solutions have been proposed and the horsemen galloped away the problems, like the poor, are still with us.

The area in which we live has had some extremely gloomy forecasts. V.S. Naipaul, the Trainidadian novelist, predicted in 1970 that:

> The small islands of the Caribbean will remain islands, impoverished and unskilled ringed as now by cordon sanitaire, their people not needed anywhere. They may get less innocent and less corrupt politicians, they will not get less hopeless ones. The island Blacks will continue to be dependent on the books, films and goods of others; in this important way they will continue to be the half-made societies of a dependent people, the Third world's third world. They will forever consume; they will never create. They are without material resources; they will never develop the higher skills. Identity depends in the end on achievement and achievement here cannot be but small. Again and again the mellenium will seem about to come.

This prediction must be based on the assumption that these societies will continue to accept the macro-state's dedication to growth and "progress" and will not eventually recognize that there is an optimum social growth and a limit to everything. If they are to survive, their "revolution" must come and it cannot be based on a rejection of reality.

Only two months ago in a paper on the "Position of Blacks in the Americas", Orlando Patterson, the Jamaican sociologist now teaching at Harvard, pointed out that

> It is ironical that even where blacks constitute the majority people or are the major ethnic group in a sub-national political unit, they have not been able to make much change on their behalf in spite of having taken over the leadership of

> established political structures. Too late, blacks have come to discover that political control without economic clout is largely an exercise in futility.

I had the privilege of serving as a discussant of Dr. Patterson's paper and I said then that perhaps societies like ours will be the places where the breakthrough is made. It has been said that the West Indies is a microcosm of the world. I believe the Virgin Islands to be a microcosm of the West Indies. We live in a kind of society (classified among the so-called "developing" countries) which is circumscribed by ecological, socio-economic and psycho-cultural constraints which are likely to make it impossible for it to "catch up" and attain the status of "developed" in the generally accepted meaning of the concept. But these societies seem to have the potential to evolve a distinctive identity by a recognition of their limitations, a re-ordering of their priorities and redesigning and restructuring of their institutions. There is evidence to suggest that we often make assumptions about them that are wrong and, therefore, draw wrong conclusions; that we unquestioningly accept that the problems of the big outside world are our problems and their solutions are our solutions. But it may well be that for a thorough understanding of what we are and where we are going, new theories and concepts may prove desirable tools for analysis. Our College in its mission of teaching and research must become a leader in the quest for solutions.

If this conference had an explicit theme it would, I think, be "what kind of society have we really got, where is it going and what are we going

to do about it". Our appraoch is to take a brief look at the kinds of research and then to form ourselves into four discussion groups (Water & Ecology, Social, Economic, and Education) and to look at these problems in terms of what needs to be done with particular reference to investigatory work which should form the basis of action.

This is the quest in which we invite you to participate because of your concern about our islands. Welcome, good luck and thank you all.

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APPENDIX II

Background Paper No. 1

Caribbean Research Institute: Research - 1966 to 1972

Beverly Bandler
Caribbean Research Institute
College of the Virgin Islands
April 24, 1973

Background Paper No. 1

INTRODUCTION

This paper summarizes the objectives and results of research undertaken by the Institute from 1966 through 1972. Officially, there have been 56 CRI projects, a few of which were in support of conferences, symposiums, or publications, but the bulk of which covered research in these categories: the arts, biotoxicology, conservation, education, hydro-geology, marine archaeology, marine resources, remote sensing technology, socio-economics and water quality. Of the total number of projects, the majority have focused on the marine/water resource field. Today there are four projects that can be considered current, or active: The Anegada Ecological Survey, the HMS Santa Monica, NEH Marine Archaeology projects, and the Inter-V.I. Studies Program.

It is estimated that some 60 reports were produced during the above referred period, 20 of these specifically on water quality control, and the balance fairly evenly divided between conservation, fisheries, the physical and natural sciences, and social sciences. However, it is fair to say that the most susbstantial or noteworthy reports were those produced between 1969 and 1972, and those were the results of the water/marine-oriented and Inter-V.I. Study programs. Of the total funding, a tentative breakdown indicates that close to 50% of the project funding has come from the federal government, with the balance split about evenly between the local V.I. Government and private sources.

Background Paper No. 1

THE ARTS

A study of the nature and extent of art activities in the U.S. Virgin Islands was completed by the Institute for the Territorial Council on the Arts in 1967. The purpose of the study was to produce a base for the Council's long-range planning.

The specific objectives of the study: 1) To inventory the folk arts of all ethnic groups in the Islands and to collect a representative sample of each; 2) To inventory and evaluate the current artistic activities of both individuals and groups, including in-school education in the arts; 3) To survey the artistic interests of a representative cross-section of the population, with a view to assessing the aesthetic needs of the society as they are defined by the people themselves; 4) To survey the artistic interests of those people who have a special interest and competence in one or more of the arts, with a view to assessing the aesthetic needs of the society as they are defined by those who have the greatest explicit influence on opinion and taste; 5) To assess potential markets for artistic products among (a) the permanent population; (b) visitors, and (c) export outlets; 6) To project the probable impact on the tourist trade of alternative programs in the arts, e.g. the festival concept; 7) To assess the possible sources of selective support for specific arts, with a view to determining the extent and overlap of patronage, sponsorship and participation; 8) To consider the relationship between local participation in the arts and the role of visiting artists and teachers; 9) To project a realistic program of selec-

tive phase-by-phase development in the arts which would meet local needs and satisfy local interests; 10) To examine obstacles that might block cooperation for artistic development and prevent the expanasion of resources in support of the arts; 11) To project alternative public policies and forms of public organization in support of the arts; 12) To propose alternative allocation of resources for support of education in the arts, amateur undertakings, students with professional promise, and professional artists; 13) To project needed facilities; 14) To summarize critically the experience of others in formulating public policy and organizing programs in support of the arts.

This project, funded by the National Endowment for the Arts, resulted in a publication, "Arts in the U.S. Virgin Islands," (Moore & Hough, 1967), which was a supplement to the Arts Study Report prepared by project personnel. A "Summary Statement on a Comprehensive Plan for the Arts in the Virgin Islands" was completed in 1967 on the basis of project findings by the Virgin Islands Council on the Arts.

BIOTOXICOLOGY

The conclusion following two investigations by CRI of fisheries development potential in the Virgin Islands was that a thorough understanding of the ciguatera problem must be developed before expansion of the V.I. fishery can be effectively accomplished. There is every reason to believe that ciguatera poisoning is a major impediment to the sale of local fin-fish in the Virgin

Islands, and is thus a strong deterrent to expansion of commercial fisheries.

Fish poisoning has been reported since pre-Columbian time and shows no sign of lessening. It falls into three major groups in this area: 1) the endotoxins from the puffer-like fishes with the additional rarely reported cases of clupeoid, elasmobranch and hallucinogenic fish poisoning, which are rarely reported, 2) scombroid poisoning, resulting from bacterial decomposition of fresh fish, and 3) ciguatera fish poisoning, caused by what is deemed a primary toxin (ciguatoxin) and several secondary toxins. The latter has the highest incidence of toxicity.

Ciguatera in its simple uncomplicated form develops poisoning within 3-5 hours after fish is eaten, with a sudden onset of gastrointestinal symptoms which occur in about 40-75% of the cases. The victim feels weak, generally ill, and may experience muscle aches throughout the back and thighs in about 10% of the cases. Neurological symptoms of numbness and "tingling" in and about the mouth and extremeties are present in about 50% or more of the cases.

A proposal for preliminary research in the study of ecology and epidemiology of ciguatera fish poisoning, "A Study of Ciguatera Poisoning in the Virgin Islands Area" (#53) received funding for one year in April, 1971. Funded by the National Oceanic and Atmospheric Administration's Office of Sea Grant Programs, with support of the United Nation's FAO office in Barbados and the College, the proposal included the location of a dependable source of toxic fish, the establishment of a facility competent to run screening bioassay

on a large volume of samples, and on a dependable schedule, the establishment of an accurate reporting system with data about incidents of human intoxication and the analysis and comparison of toxin.

The better part of the spring and summer was needed to complete the chemistry and bioassay laboratories required by the project at Benner Bay (VIERS). While the construction of the laboratory delayed progress of the project, ciguatera staff were able to institute procedures for the reporting of ciguatera incidents and published the "Physicians' Information Summary," "Guide to Fish Poisoning in the Virgin Islands," and "Guide to Identification of Poisonous Fishes in the Virgin Islands."

In the fall about 2 tons of fish arrived from UN-FAO cruises in the northern Leeward Islands, and project personnel began extracting and bioassaying the samples. While this data can provide a more precise estimate of the proportion of ciguatoxic fishes in the deep shelf, shelf-slope populations, it has already been ascertained that this resource is not free of ciguatoxin.

The synoptic paper, "Fish Poisoning in the Eastern Caribbean," written by the project director and delivered before the 24th annual Session of the Gulf and Caribbean Fisheries Institute in November, 1971 summarizes and concludes:

> "1. Fish poisoning in the eastern Caribbean is reported from all of the islands of the northern Virgin and Leeward

Islands groups. Puerto Rico, Hispaniola and St. Croix have a much lower incidence rate as do the Windward Islands (Trinidad to Martinique).

2. Although clupeoid, elasmobranch, tetraodontoid and hallucinatory fish poisoning are reported from the eastern Caribbean, scombroid poisoining and ciguatera poisoning are considered to be most important. Because scombroid poisoning can be prevented by modern preservation techniques and treatment of the disease is specific and effective, it is considered a less severe problem than ciguatera poisoning.

3. Epidemiological reporting of ciguatoxications has only been begun in the last month throughout the Virgin Islands and a careful survey of the Leeward Islands must await additional funding. Ciguatera is presently reported as a severe public health problem with only a fraction of the cases reaching medical attention. The problem seems most severe in the area from Montserrat north to the British Virgin Islands including the southeast portion of Saba Bank and the southern shelf of the Virgin Islands plateau.

4. The chemistry, pharmacology and ecology of ciguatoxin and closely allied compounds are at present

poorly understood. The symptomology and species distribution of the toxins in the eastern Caribbean strongly suggest that a situation exists which is very similar to that described from the Pacific islands by the Marine Biotoxins group at the University of Hawaii over the past 16 years.

5. Toxicity in eastern Caribbean fishes seems to be more prevalent among the large carnivores of reef or reef-related habitats. There are a number of data which suggest that ciguatoxin(s) are produced by some organism in the reef food web and that the toxin is passed through the food web without significant modification and is concentrated by the larger carnivores.

6. Development of the commercial fisheries in the eastern Caribbean is severely impeded by the prevalence of ciguatoxin in commercially desirable species. There is good evidence that the shelf-edge stocks of snapper and grouper are not free from ciguatera poisoning as previously presumed and that exploitation of this presently underutilized resource may be impeded by this toxicity."

This preliminary research was completed in June of 1972.

Background Paper No. 1

CONSERVATION

The Institute's project directed to the development of the Caribbean Conservation Association began in 1970. The association was an outgrowth of the Eastern Caribbean Conservation Conference held at Caneel Bay, St. John in 1965, attended by 64 participants, conservationists and policy-makers from Antigua, Barbados, British Virgin Islands, Grenada, Jamaica, Martinique, Montserrat, Puerto Rico, St. Lucia, St. Kitts, Trinidad, the United States and the U.S. Virgin Islands. The conference resulted in a resolution to establish a Caribbean Conservation Association to serve as a foundation for regional and international cooperation in the conservation of the Caribbean's natural resources and assets. The association had its inaugural meeting in May, 1967 in Grenada.

In 1969 the necessity for implementing an actual conservation program for the region became apparent, and the Caribbean Conservation Development Program project (#39) was initiated. Between the summer of 1969 and 1970 a systematic island-by-island survey and recruitment effort for government and conservation group support was made. The results determined the needs in the region for technical, organizational, financial and scientific assistance. A four-year conservation program was prepared at the end of that year, and approved (Spring, 1970). The program was to be administered and managed by the Institute, and while initial funding was to come from external sources, the program was designed to enable CCA to generate its own funds and become

autonomous by 1974. Its aim was to effect the emergence of a regional policy on environmental management with efforts aimed at technical assistance, demonstration projects, information programs, fund raising for specific projects and environmental and park management training.

The project remained for two years at the Institute, with funding in the amount of $30,000 for the first year and $25,000 for the second year from the American Conservation Association. In addition, $12,325 was raised outside ACA. A familiarization trip was made by CCA's executive director, covering 8 countries in 1971, and consistent contact was effected over the two-year period with Grenada, Trinidad & Tobago, Surinam, St. Kitts, Barbados, Dominica, St. Lucia, Antigua, Guyana, and the British Virgin Islands. By September of 1972, CCA had 31 full memberships and 71 associate memberships.

CCA contributed support in terms of monies and consultive services to such projects as the restoration of the Prince of Wales Bastion at Brimstone Hill on St. Kitts, the Proton Magnetometer Search for Marine Archaeological Sites in the Virgin Islands, a comprehensive park development program on St. Lucia's Pigeon Island, an ecological survey of Graeme Hall Swamp in Barbados, the restoration of the Victoria Museum on Dominica, the establishment of a museum in the British Virgin Islands, and the establishment of a National Trust and a museum system in Antigua.

The project (#46) was transferred from the College in September of 1972.

Background Paper No. 1

Of particular note in this area were two trips made to Aves Island, 175 miles south of St. Croix, and reported to be one of the largest remaining nesting sanctuaries in the eastern Caribbean for the green turtle. One of the five species of sea turtles known to live in the Caribbean, the green turtle is the most important economically as it is an important food resource and item of commerce.

These trips, made in 1971, were supported by ACA and Mr. Myron Hokin along with the Institute, and comprised the first major tagging effort ever made at Aves. A paper resulting from these trips, "Distribution and Management of Caribbean Sea Turtles," (William E. Rainey), point to the need of developing a meaningful regional management program requiring collection and exchange of exploitation data and greater coordination and expansion of existing locally-oriented conservation programs, if the green turtle, of which the fecundity is low compared to other marine organisms, is to survive.

Three proposals were written in 1971 on the basis of these trips, for a) a nesting survey of the Eastern Caribbean islands, b) a continuation of the Aves Island study, and c) a green turtle mariculture project. They remain unfunded.

EDUCATION

Private funding was given to the College in the summer of 1964 for a research project to study the colonial educational system of the Virgin

Islands. The one-year grant resulted in a published manuscript, "The Moravian Mission to the African Slaves of the Danish West Indies (1732-1828)."

The publication's conclusion was that characterized by a concern for the moral and intellectual well-being of the Negro slaves and placing attention upon individual instruction in both religion and education, the example set by the Moravian missionaries in the Danish West Indies during the years 1732-1828 provided the foundation upon which emerging colonial social patterns in the area were to be established. The guidelines for instruction were recommended by the Moravian leaders but were also reinforced by island mores which had inhabited group gatherings among Negroes, leading to the subsequent emphasis upon "individualized" instruction by the Moravian teachers and preachers.

The thesis is that the Moravian Mission lent encouragement to the Negro slave to prepare himself for the assumption of responsible positions within the Church hierarchy and the community, and taught that manual labor was not necessarily degrading and could bring greater economic security.

(Please refer to Harrigan and Varlack publications under the Socio-Economic Research section in this paper.)

HYDRO-GEOLOGY

Beaches are composed largely of cabonate material which comes from

the shell material of offshore organisms. The processes which move this material shoreward to form beaches is extremely slow so that littoral sands removed from the system by man can be replaced by nature only over a period of many years. There is undoubtedly a point in the removal of sand at which the destruction of beaches becomes irreversible for all practical purposes.

Sand and gravel have been removed from beaches and harbors in the Virgin Islands for as long as cement has been used as an essential building material, and this dates back to the early 1700's. However, due to the larger quantities and more frequent removal, some Virgin Islands beaches were showing visible signs of ill effects from sand removal in 1970, sand removal, that is, from waters near shore.

The demand for building aggregate had reached such proportions that it is estimated that roughly 700,000 cubic yards of sand had been dredged over a period of a few years prior to early 1971. The undesirable consequences was a disturbing degree of inshore water pollution and alterations of beach shorelines, in particular on the north shore of St. Thomas. In early 1971 an agreement had been reached between the V.I. Government, the U.S. Department of the Interior, and a local firm supplying aggregate, namely Zinke-Smith (now Controlled Concrete), to cease dredging following a stockpiling of 100,000 cubic yards of sand for immediate future needs. However, it was apparent at that time that other sources of sand and building aggregates were essential if

shoreline and bay ecologies were to be protected and the ever-increasing demand for such material filled. The only alternates available to near-shore dredging: a) fine aggregate from quarry rock, b) importation of fine aggregates from the continental U.S., c) importation of fine aggregates from surrounding islands, and d) dredging of fine aggregates offshore.

On this basis, CRI initiated discussions with the U.S. Geological Survey in the summer of 1970 which resulted in an initial agreement to effect a cooperative marine geology effort in a reconnaissance survey of the shallow shelf area south of St. Thomas and St. John. Local matching funds in the amount of $14,100 were provided by Zinke-Smith, Inc. The purpose of the survey was to prospect sand off the south coasts of these islands in order to discover, describe and chart offshore deposits of sand suitable to be mined for making concrete landfill and beach replenishment.

This project, Cooperative Geology Project (#45), was important to the Virgin Islands in view of :

> 1) the critical and immediate need for background data to support pollution studies; 2) the critical and immediate need for finding new sources of sand aggregate in areas where mining would not have an adverse effect on shoreline and bay ecologies; 3) a desire to expand support and facilities for marine research in the College and its research facility, CRI.

The project was of value to U.S.G.S. because:

1) the area is a relict product of lower sea levels and it was presumed to reflect the Pleistocene history of the eastern Greater Antillean ridge in much detail; 2) its sediment cover is mostly a relatively pure accumulation of skeletal carbonate material which should offer good possibilities for ecological and paleoecological studies; 3) structural studies on the shallow platform would relate to U.S.G.S' long-range goal of understanding the tectonic history of the Greater Antillean ridge; 4) the clear shallow waters of the area make it ideal for correlative studies of bottom characteristics and remote sensing techniques; 5) it was an offshore extension of the Tektite I and II project area, which had been undergoing intensive study by geologist-divers at that time.

Benefits from such a project would be the establishment of a framework for more detailed studies to follow in order to develop an understanding of the dynamic system which transports and mixes island-derived clastics with offshore carbonate particles. It was hoped that the study would result in knowing whether the system was closed and non self-replenishing, or whether it was open-ended, with a source and a sink, whether the forces which generated sand supplies were operable or whether the sands were relict from some ancient environment, and that the study would provide a basis for designing research problems. It was hoped in addition that the implementation of this

first work would be a base upon which a continuing multi-year cooperative effort could be built as has been done in Puerto Rico. The Virgin Islands would benefit substantially from free ship operating time, equipment availability, and the correlation and direct use of data and samples from geologists and physical oceanographers of the Marine Geology Unit of U.S.G.S.

U.S.G.S' research ship, R/V ADVANCE II, which had performed seismic profiling under the Ocean Survey Program of Tektite II during April of 1970, collected some 70 sediment cores in October on the basis of the agreement with CRI. These samples underwent textural and mineralogical analysis to determine the patterns of sediment distribution, and a bathymetric map was made describing the bottom composition, sub-bottom structure, and geophysics of the V.I. platform south of the two islands.

The report resulting from the project is entitled, "Geology of the Insular Shelf South of St. Thomas and St. John," (Louis E. Garrison, Charles W. Holmes, James V.A. Trumbull; U.S.G.S., 1971). It concludes that under the influence of currents and local shelf topography sand was exposed in three areas: a) west of Brewers Bay, b) near Buck Island, and c) south of St. John, with the most promising site for initital exploitation appearing to be that of the area off Brewers Bay, southwest of the airport. This area is of particular note in view of the urgent problems of solid waste disposal for St. Thomas and the land surface requirement in stockpiling a large quantity of dredged material. This sand bank is located in depths ranging from 60 to 130 feet, with initial

probings indicating that there may be a 30-40 foot bank of usable sand. The report indicates that further work is needed in order to estimate the total exploitable resources available at each site, such estimates being dependent on the depth of the sand bank, dredging and stockpiling economics, and forecasting/weighing of eco-system disruptions.

On the basis of the original idea to effect a long-term marine geology exploration and a resultant development of an investigation program for government and industry, CRI explored the possibility of continuing research of offshore resources and made application to the Sea Grant office of NOAA (National Oceanic and Atmospheric Administration) for a three-year study of these resources and the beach and platform dynamics, with local funds to be supplied by Zinke-Smith and the V.I. Government. In addition, CRI attempted to encourage the release of $20,000 in V.I. Government funds appropriated by Act 2892 (Bill 4670) of the 8th Legislature, signed by the Governor December 23, 1970 for support of a marine geology program. No funds were released. It was hoped at the time that funding would allow for two sub-projects, one to chart and quantify specific areas of sand in the Brewers Bay location for safe exploitation, and off Hassel Island, and one to conduct a reconnaissance of the St. Croix platform.

Efforts to obtain additional funding for the continuance of the program were unsuccessful, and this initial project was terminated.

Another effort in the area of marine geology was authorized by the Governing Board of the Virgin Islands Water Authority (WAPA) at their meeting of July 23, 1970. The Caribbean Research Institute was authorized to furnish data and a sea bottom survey which would include the oceanographic, geophysical, meteorological and certain hazard factors pertinent to determining a feasible route for laying submarine cable for transmitting electric power between the two islands. It was the task of the project to make adequate data and survey records available to those with the competence to choose and evaluate potential routes based on cable design factors, cable laying techniques and cable lifetime experience factors.

A preliminary review determined that available bathymetry and submarine geology coverage was not sufficient for a technical feasibility evaluation, and that a data acquisition cruise would be necessary. Project personnel conferred with the Naval Oceanographic Office, the Naval Research Laboratory, the Coast & Geodetic Survey of ESSA, and the Geologic Survey of the Department of the Interior. The result, with the aid of a request from the Governor, was that USNS GIBBS agreed to concentrate several days of ship's operations in the area October 23-28, 1970, and the additional data was produced.

Questions that needed answers: Was there a reasonably direct route between St. Thomas and St. Croix at a maximum depth less than 1,850 meters (1,000 fathoms)? If not, what was the maximum depth of a least depth route, and what was the general bathymetric regime? What were the sea floor and

and the sub-bottom characteristics along the least depth route and generally in the area, relief, sedimentation, slumping, currents and sub-bottom strata?

The final report of the project, Cable Survey project (#44), is entitled, "Notes on Some Oceanographic and Marine Factors in the U.S. Virgin Islands," (Robert P. vanEepoel, Wadsworth Owen, Arthur E. Dammann, 1971). It contains data in the following categories: Oceanographic and Geophysical Data, Wind, Seastate and Storms, Water Currents, Water Pollution Problems, Potential Biological and Fisheries Hazards, Anchorages and Harbors, Ship Traffic and Potential Obstacles, along with charts and general comments and recommendations.

Project personnel concluded that the least depth route must traverse bottom areas deeper than 1,850 meters (the deepest section of the route is actually below 2,100 meters (1,130 fathoms), and any route between the northern Virgin Islands and St. Croix must traverse areas of rugged relief and precipitous slopes. The data gathered indicated that bottom currents in the passages are probably moderate, sedimentation probably occurs at a rate similar to that of the rest of the western tropical Atlantic Ocean, that seismic activity in the area is at the rate of up to 20 events per day at a level of up to magnitude 1 Richter, with events at 3.5 Richter occuring at the rate of about one every two years.

The report recommended that the engineering design phase include a rather intensive inspection, survey and measurement of the candidate cable

routes by deep operating submersibles, that further consideration of the interconnection cable feasibility include a good familiarity with work being done in connection with an extensive multi-year investigation which includes a study of the Anegada Passage and the Virgin Islands Basin, and that the western 40 per cent of the southern coast and the western coast of St. Croix be considered the least desirable shoreline for a cable landing in view of the higher risk factors based on heavy ship traffic, complex seawater chemistry/pollution and hazards from the Atlantic Fleet Weapons Range of the United States Navy.

The project terminated in March of 1971.

MARINE ARCHAEOLOGY

The Marine Archaeology Program is the result of a conference on marine archaeology in the eastern Caribbean which the Institute hosted in 1968. At that time marine archaeological work in the area was marginal, with no major on-going institutional efforts, few pertinent publications, and no systematic site conservation and excavation program--merely scattered individual workers, many of whom were amateurs and/or souvenir hunters.

The program was officially launched in December, 1969 in recognition of the importance of historic wrecksites to an enlarged knowledge of the history of the Caribbean islands as well as the potential contribution of such archaeological program has made its advisory services available to all West Indian governments--to aid in the proper excavation of shipwrecks and other under-

water archaeological sites; to assist in the preservation and display of uncovered artifacts; to help protect historic sites from inroads of development, and to assemble and disseminate the knowledge gained from these finds.

The marine archaeology staff have been excavating two shipwreck sites over the past two years. With the cooperation of the British Virgin Islands Government, work has been done on the excavation of the HMS Nymph, the British sloop of war that burned and sank in Roadtown Harbor, Tortola, B.V.I. in 1783. The Department of the Interior granted permission for the excavation of the HMS Santa Monica, a British warship that sank in Coral Bay, St. John in 1782. A contract was signed between the College and the V.I. Government through its Department of Conservation & Cultural Affairs authorizing the Institute's direction of excavation operations and the preservation of the artifacts from the shipwreck over a one-year period.

The latter represents Project #47, the HMS Santa Monica project. The wreckage was discovered by a member of the Institute staff in 1970. According to available records, this ship had been captured from Spain by the British and put into service in the West Indian fleet by the Royal Navy. It sank as a result of hitting a rock south of Norman Island. To date, the inventory of artifacts from this wreck have amounted to bottles and bottle fragments, mustket balls, pieces of coal, pewter buttons, ceramic fragments, and miscellaneous bits of tools, fixtures, etc. along with several barrels.

In 1971 a grant was received for a proposal "To inventory and assess

the marine archaeological resources of the Virgin Islands and prepare a register of historic underwater sites in the Virgin Islands." An ancillary objective was to commence the development of a resource management plan for the principal marine sites on the Virgin Islands platform, and to bring to the attention of government officials and concerned citizens the vast unused potential for historic research that lies on the ocean floor. The project was funded through the National Endowment for the Humanities with half of the funds contributed by Virgin Islands residents, and is officially titled, "Proton Magnetometer Search for Marine Archaeological Sites in the Virgin Islands." (Project #48).

On the basis of the NEH grant, the William F. Donner Foundation fulfilled its commitment to give the College $10,000 for the purchase of a proton magnetometer, a highly sensitive and sophisticated electronic device used in the survey of wrecksites. This instrument detects variations in the earth's magnetic field due to large masses of iron such as cannon, anchors, and rigging hardware of sailing vessels.

The Proton Magnetometer Search project is now in its middle stages and is expected to be completed by June 30, 1973. To date survey concentration has been on the area of Packet Rock and in East Gregorie Channel on the south side of St. Thomas. Project personnel have discovered four wrecks, two 20th Century wrecks and two which, upon superficial inspection, seem to date from the period between 1790 to 1820. The latter two wrecksites have produced artifacts.

Background Paper No. 1

MARINE RESOURCES

Submerged Lands

Completed in July, 1965 was a preliminary study of the industries which utilize bottom materials in Virgin Islands territorial waters with recommendations on policies which would permit extractive utilization while conserving marine and littoral environments. The basis of the Submerged Lands project (#7) undertaken by CRI was contained in a memorandum of agreement between the Virgin Islands Corporation and the College dated April 6, 1965. The agreement called for research and analysis regarding certain questions as to dredging in the Virgin Islands, with an interest in determining the amount to be charged for the material, the most practical method of determining amounts removed, the definition of the material (i.e. should the government distinguish between sand, gravel or coral), the history of dredging in the Virgin Islands, the effect on building and construction costs, etc.

The final report, "A Study of the Submerged Land Resources of the Virgin Islands," (Thomas R. Herrick, 1965), dealt with the overall questions on dredging above, the ecology and geology of submerged lands, the jurisdiction of the Army Corps of Engineers, and future research.

The report is "dated" in terms of currently existing legislation and a changed approach to submerged lands and coastal zone management. However, of interest is the section covering the history of dredging in the Virgin Islands. With regard to future research, the report does state that basic beach and

marine geological studies had to be completed before an intelligent dredging policy could be established. It recommended that two main lines of activities be pursued, one concerned with navigational channels and related questions; the second in relation to preserving the marine and shoreline environments of the Virgin Islands.

Specific recommendations were for a definite survey of all dredging activities in the Virgin Islands to date, a survey of all existing and potential navigable waters around the Virgin Islands, a seabottom survey of the submerged lands around the Virgin Islands, an ecological study of Virgin Islands marine life, an analysis of the sediment producing fishes and marine plants, an analysis of beach and coastline erosion and formation in the islands.

Fisheries

The Institute's marine resources exploration began in 1965 when VIERS personnel initiated a project entitled, "Study of the Fisheries potential of the Virgin Islands." Prior to the completion of the fisheries laboratory at Lameshur Bay at the end of 1967, the project was carried out at Chocolate Hole, St. John.

The project, initiated in August of that year, was funded jointly by the Bureau of Sport Fisheries and Wildlife and the Bureau of Commercial Fisheries, at that time both in the Department of the Interior, along with matching funds from the V.I. Government. This initial phase of the fisheries program ran for three years.

Background Paper No. 1

The objective of the joint program was to study both the spot and commercial fishery potential and to determine the extent of which long-range commercial fishing was feasible. In addition, the project was to investigate methods of harvesting and handling which would have practical value in improving and conserving the V.I. fishery. Basic facts as the number of species, their distribution, general biology and a host of related factors on the fishery in the islands were either poorly understood or completely unknown at the time the program started.

The result of the three-year study determined that the local shelf area available for fishing is only about 2,000 square miles extent (in comparison, the Virgin Islands shelf is about half as large as the Hawaiian shelf where fisheries had produced 13,000,000 lbs. of fish in 1966, mostly tuna; the Gulf of Mexico has 112,000 nautical square miles of water less than 100 fathoms deep). The result is reduced habitat diversity and reduced potential for large populations of many valuable species of molluscs, shrimp and fish. While a bewildering array of species were discovered, each species was represented in comparatively small numbers, with deep-water snapper fishing holding the only promise along with squids and octopus. Investigators singled out eight species for potential future mariculture projects: turtle, conch, squid, mangrove oyster, spiny lobster, whelks, octopus, and several species of crabs. (It was on the basis of these investigations that a major proposal for the development of lobster management techniques was submitted to the National Science Foundation.)

Background Paper No. 1

The final report for this joint project (#10 & #24), "Study of the Fisheries Potential of the Virgin Islands," (1969), concluded that the V.I. fishery was affected by five basic factors:

1. While the sport fishing charter boat fleet could probably expand several times, such expansion had to be considered carefully since charter-fishing operators had found operation economically prohibitive. The cost of procuring, maintaining, and operation of power boats was extremely high in cost.

2. With regard to commercial fishing, a major difficulty was in convincing young men that there was a future in fishing, and that it was possible to make an adequate and respectable livelihood from commercial fishing.

3. Modern, sanitary and suitable marketing procedures were lacking in addition to an unawareness as to the edibility and desirability of certain species which could enter the market (species such as bill-fishes, tunas, sharks and sardine types.)

4. The effect of ciguatera toxin on the retail and wholesale market value of local inshore fish was difficult to analyze at that point, though indications were that no local fishery could be developed without a total understanding of the problem.

5. The nature of the V.I. shelf area poses severe restrictions on the numbers and kinds of fish which are present, and on the methods which could be used to harvest them.

The report recommended a government or privately sponsored education program for fishermen along with financial help in the form of loans or actual subsidication for procuring equipment, the formation of a cooperative for fishermen, the provision of "fish-markets," a cooperative to reduce the high cost of supplies, parts and services, along with advertising and education regarding the marketability of certain species of fish. Research efforts to increase the efficiency of fish traps, miniature longlines, and the harvesting of small schooling fishes at night with light and pumps for possible live bait fishery were also recommended.

This initial phase terminated in August 31 and was followed by the project entitled, "Exploratory Fishing for a Source of Non-Ciguatoxic Sport and Food Fish." which extended from September, 1969 to June, 1970. With preliminary fisheries potential survey having verified the major deterrent to fisheries development, the new proposal was guided by two factors: (1) Some biological and experimental evidence suggested that ciguatera toxin might not exist in deep water fishes, i.e. fishes in 50 fathoms of water or greater, due to conditions precluding certain light requiring algae. (2) Observations over the previous 3 years had indicated that the cost of fishing within the Virgin

Islands shelf, which does not lend itself to trawling or dredging-type fishing operations due to widespread abundance of coral heads and patch reefs, was not justifiable. In addition, exploratory reports had indicated that the offshore hook and line fisheries would not be successful because of the small size of fish schools and the difficulties experienced in hooking such fishes as tunas. The cost of a full fledged long line or purse seine operation also seemed prohibitive, leaving the only possibility for sport and commercial fin-fish efforts in deep water at the edge of the Vigin Islands shelf.

On the aforegoing basis, the objective of the 1960-79 project was to (A) fish deep waters at the edge of the 100 fathom curve that defines the Virgin Islands Geological Shelf, with the intent of locating fishing grounds which were free of ciguatoxic sport and food fish (primarily snappers and groupers); (B) establish a bioassay or other rapid method of testing large numbers of individual fish for the presence of ciguatoxin, using both vertebrate and invertebrate animals, fertilized eggs of various animals and chemicals which suggested themselves as related to the nature of toxin.

The better part of the year was spent outfitting the boat used for sampling, testing the boat and equipment, experimenting with gear types and variations and working out a feasible approach to sampling. About 215 hours of boat time from January to June, 1970 resulted in a total of 29 trips, 17 of which produced useful catch data and 12 of which were accounted for by shakedown cruises and attempts at overcoming problems due to gear or

weather. A total of 1,357 lbs. of fish were caught as a result of sampling done on the north and south slopes of the shelf, between 5 and 25 miles from the east end of St. Thomas. 12 volt electric reels were used as gear.

The July 1970 final report, "Exploratory Fishing for a Source of Non-Ciguatoxic Sport and Food Fish," (A. E. Dammann, J. A. Yntema, W. N. Brownell, R. W. Brody, and A. A. Spandorf, 1970), concluded that while the Antilles in general contain sparse fishery resources a small native fishery could be quite productive and possibly quite profitable. It was determined that the deep water species with the greatest commercial potential in the Virgin Islands (and all Leeward islands in general) is the silk snapper, a fish abundant in water from 60-150 fathoms and apparently totally non-ciguatoxic. Another highly desirable snapper, the blackfin, was also caught in appreciable numbers. In addition, project personnel concluded that since weather is a formidable deterrent to hook-and-line fishing, solutions must be found for utilizing boats and gear designed for unsettled weather and seas. Fisheries staff recommended that a comparison of fish pot versus electric reel catches be made.

The project report recommended that the local government accept the responsibility for stimulating development and that it establish guidelines for V.I. fishery; that V.I. Government fisheries personnel take an active part in stimulating local fishery development; that fishermen who retail their catches locally be licensed, the latter assuring some kind of quality control and enforce-

ment of conservation methods; and also recommended was the establishment of a co-operative type fish store to encourage greater selection, improved quality and constant supply.

A significant contribution of the VIERS fisheries personnel during the project was their effecting the enrollment of two native Virgin Islanders in the Fisheries Officers Training Course in Barbados. The Virgin Islands had its first trained fisheries personnel as a result--an important first step in developing V.I. fisheries.

Results of the experimental mongoose and mouse bioassays were conflicting and the variability of human resistance to "toxic" fish supported the conclusion that little progress towards the development of a simple rapid test for the presence of ciguatera toxin(s) had been made. The magnitude of the problem remained unknown. According to the report, while fish poisoning is a common problem among the population of the lesser Antilles fisheries, research at this point did not demonstrate that ciguatera was prevalent or even more than sporadically demonstrable in local fish. Fisheries research, however, was hampered by the lack of reliable epidemiological data in obtaining toxic fish at this time. Thus, a program of development of sophisticated techniques and research involving purification and development of bioassays was indicated. With the biogenesis of the toxin and its transmission through the food chain being virtually unknown and with no accurate record indicating which species are incriminated in Virgin Islands waters, and in view of the

short time base for sampling, considerable research was supported by fisheries personnel before any accurate picture of the non-toxic resources could be presented.

The third fisheries proposal, "Reseárch and Development of Deep Water Commercial and Sport Fisheries Around the Virgin Islands Plateau," was funded for the period July, 1970 through June of 1971. This last phase investigated the biological potential and defined the exploitable resources of bottom fishes around the 100 fathom curve through exploratory fish with electric and manual reels, bottom set lines and traps, and assisted local commercial and sport fishermen in locating these resources and provided them with information about the appropriate gear, methods and financing possibilities.

The final report, "Research and Development of Deep Water Commercial and Sport Fisheries Around the Virgin Islands Plateau," (Willard N. Brownell & William E. Rainey, 1971), reconfirmed the environmental factors that shaped and limited the fisheries of the Virgin Islands and the eastern Caribbean island arc in general, i.e. low primary productivity, limited pelagic fish stocks, largely unexploited bottom fish stocks at the shelf edges, association of commercially significant aggregations of fish in areas limiting the types of fishing techniques (and which contrasted with traditional use of traps and handlines), the imposition of ciguatera, depletion of stocks due to fishing pressure and pollution.

The study concluded, however, that while factors did limit the poten-

tial, the findings determined that commercially exploitable populations of snappers (silk & blackfin) and groupers do exist on the steep slopes of the margins of the island plateaus, and that it was both feasible and necessary to expland the V.I. fisheries activities, aiming development at local demand. Fisheries personnel reiterated earlier findings that the market potential could lead to an economically integrated fishing industry for the roughly 400 individuals in the V.I. who earn at least part of their livelihood from fishing, and that to achieve this potential, basic improvements in boats, gear, shore facilities and landings of fish were indicated.

The FY71 fishing efforts were directed at investigation of the entire slope below the St. Croix shelf edge and similarly, the periphery of the Puerto Rico-Virgin Islands shelf (eastern portion) from St. Thomas to Anegada. No fishing was done in depths below 200 fathoms. Because of the great number of variables involved, the sample size was not large enough to make any statistically significant comparisons of locations, seasons, or times of day with regard to yield of fish. However, among all the sampling areas, it was apparent that three areas were considerably more productive than others: the north slope of Lang Bank near St. Croix, the whole north slope parallel to St. Thomas and the area north of Anegada and Virgin Gorda.

Based on the data gathered as a result of 972 hours of boat time (4,641 lbs. of fish caught), the determination was made that weather, bottom habitat, gear and bait favorable, silk and blackfin snappers were abundantly

distributed, with blackfin snappers dominent in water 20-60 fathoms, and silk snappers dominent in water 60-170 fathoms. Trap fishing catches were greatest in the depth range of 85-105 fathoms; reel fishing efforst were greatest in water 110-130 fathoms. Experimentation with five types of traps indicated that the general steepness of the V.I. shelf edge restricts this potential trapping area to approximately one-third the total area sampled. As to ciguatera incidents, fisheries personnel caught only a few ciguatoxic fish off the edges of the shelf, documenting only six cases.

The final report of 1971 supported basic action to develop V.I. fisher ies through the establishment by the government of programs and guidelines through 1) training programs, 2) fisheries extension activities, and 3) legislation. Recommended also was a shift in emphasis of fishing effort rather than a great intensification of effort, easing the overexploitation of the reef fish populations of the inshore areas south of St. Thomas and north of St. Croix and focusing on the shelf-edge populations away from the islands which are scarcely utilized at all. Pointing out that large investments in trawler-type boats, purse seines and roller trawls would cause rapid depletion of the limited available stock and would be economically unwise since such equipment would not yield long-term catches, it was recommended that the shelf slopes in the eastern Caribbean could probably sustain a sizeable native fishery operating from small boats between 22-36 feet, boats and equipment could largely be constructed locally. Also recommended was further fisheries research in gear efficiency in local waters. It was noted that conservation measures must be continuously

studied, revised and enforced, with landing records being essential to monitoring trends in fish populations.

Lobster Management

One of the highest priced food items in the world is the spiny lobster, a well known local marine resource. However, despite the economic importance of this animal, otherwise known as Panulirus argus little is known about its ecology, behavior or vital statistics. The lack of this knowledge precludes the formulation of intelligent management policies.

The objective of the CRI study was to define the population ecology, behavior and vital statistics of this lobster on the island of St. John. The study, which examined the lobster population within the 10 fathom curve around St. John, ran for the period April, 1970 - June, 1971, and consisted of two phases:

> Phase I - covered the period May-September, 1970 and was concerned with defining population size, turnover, recruitment and other dynamic aspects as well as individual patterns of habitation and movement of lobsters within the vicinity of the Tektite Habitat, the latter located at Great Lameshur Bay on the south side of St. John. Intensive observations during this period permitted the gathering of information on causative variables influencing overall population behavior. This phase encompassed three missions of Tektite II with scientists living on the ocean bottom for

periods of 3 weeks per mission allowing for intensive daytime/night time dives to inspect the local population Surface divers were also employed during Tektite Mission intervals.

Phase II - covered the period October, 1970 to May, 1971. Diver scientists operated from the surface during this portion of the study with emphasis placed on estimating the lobster population of the island. Lobsters that had been tagged in the first phase of the study were recaptured for analysis of growth, movement patterns, population turnover, feeding behavior and reproduction.

A summary of findings of the study: "1) The population of P. Argus in the various areas of Great Lameshur Bay was estimated by several techniques and the hypothetical estimates themselves assessed. 2) The population around St. John within the 10 fathom curve was estimated by random sampling at 17,040 lobsters on any given day. 3) Lobsters tended to be found at interfaces between the reef and grass or algal flats. 4) A high rate of turnover at two sites was indicated with emigration between .6% and 3.1% each day and immigration from another population at 2.7% per day. 5) The sex ratio of newly settled larvae is probably 1 to 1. It remains so while the lobsters are in the juvenile mangrove habitat, but once recruited to the reef population, sexual dimorphism in movement and possibly recruitment results in varying sex ratios. Male imiigration-emigration is more variable than for females: male: female ratios varying from 40%-75%. 6) There appears to be fall and spring

peaks in recruitment of lobsters less than 80 mm in carapace length from juvenile populations. 7) It is hypothesized that a large off-shore population exists. 8) Most spiny lobsters in the reef area resided in dens correlated positively with the number of occupants and frequency of multiple occupancy, i.e., dens most frequently occupied had two or more occupants. 9) Den selectivity is shown by individuals found in the same den for periods up to several weeks. Furthermore, lobsters having left the entire area occasionally returned to the same den (or one nearby) up to several weeks or months later. 10) Frequently occupied dens (coral platforms, rock ledges, boulder overhangs) were similar in general appearance to unoccupied structures although dens tended to have portions restrictive to anything larger than a lobster or a deep portion permitting withdrawal by a provoked lobster. 11) Lobsters remained in dens during daylight, leaving during the four-hour period following sunset to forage on the reef or sand-algal plain up to 200m from their den. Lobsters returned to the reef area during the four hour period before dawn. Between 8% and 48% of lobsters may remain in their dens each night. 12) Lobsters feed nocturnally by predation (and some scavenging) on a variety of reef and grass-algal flat animals, particularly mollusks, crustaceans and urchins. Available food is apparently not a limiting factor. 13) Homing behavior after foraging, often involving return to the same den, was documented by long-term resighting and remote sensing. Even lobsters physically displaced 200m returned to the area of capture. 14) Those lobsters that emigrated out of a study area apparently moved offshore or directly across the embayments through open areas rather

than moving a short distance along shore. Sonic tracking showed rates of locomotion approaching 1Km/hr during such movements. 15) Reproductive activity, as indicated by females with sperm packets and eggs, is highest in the spring and fall (although data were not taken in November and December). 16) Females may reproduce several times in a year. They enter the reef population in the second year of benthic life, but do not produce eggs until the following year. 17) A new technique for deriving mortality coefficients from size frequency distribution is presented and used to estimate mortality for lobsters. It is apparently quite low in benthic lobsters, a conclusion supported by analysis of Lameshur Bay populations. 18) Mortality from predation was only observed once when two snappers killed a lobster. Indirect evidence of mortality from sharks and groupers is presented. 19) Tag recapture data and size frequency analysis was fitted to the Van Bertalanffy growth curve. The results, which agreed closely, indicated sexual dimorphism in growth. 20) Growth in length was converted to growth of total body weight based on carapace length. 21) Consideration is given to the effects of divers on the behavior of lobsters. A dispersal effect from frequent handling is described."

The aforegoing is an excerpt from the final report ot the funding agency, the National Science Foundation of Sea Grant Programs, entitled, "Ecological Study for the Development of Lobster Management Techniques," (William Herrnkind & David Olsen, 1971).

Background Paper No. 1

Reef Ecology & Marine Pharmacology

An arrangement was made between the College and the University of Oklahoma for the Institute to collect and identify diverse Caribbean marine organisms for transmittal to University of Oklahoma research laboratories. This agreement, made in the latter part of 1970, was for the purpose of enabling the university to make chemical extractions for shipment to the National Institute of Health for investigation of the potential of marine organisms providing chemotherapeutic anti-cancer agents. 40 samples were sent to Oklahoma in the first quarter of 1971. While there was an interruption in this project, other arrangements were made to supply the research project of the Department of Pharmacy of the University of Wisconsin with Plexaura homomalla specimens (soft corals). The latter are the best known natural source of prostaglandins, the foundation chemical for the once-a-month birth control pill. Discussions were held in the final quarter of 1971 with regard to future research activity to include field ecology and growth, and rapid chemical separation and analysis.

MENTAL HEALTH

According to a report done by the Bureau of Mental Retardation of the V.I. Division of Mental Health in 1965 (O'Donahue), the Virgin Islands had an estimated 30% level of retardation at that time. The studies done by the Community Studies Unit under the direction of Hazel DuBois Stanton were aimed at ascertaining the cultural factors affecting mental retardation in the V.I. The studies were funded under agreements between the Department of Health (Division of Mental Health) and the College of the Virgin Islands through the

Institute.

The final report submitted by the project director in 1966 covered three areas:

(1) Analysis of the relationship between measured intelligence and measured achievement as related to demographic, cultural and attitudinal data: The results of California Achievement Tests and Large Thorndike Intelligence Tests for 1,494 St. Thomas children were compared and correlated by the Community Studies Unit. Families of 104 of these children were included in a household census survey. The sampling was divided into two groups, overachievers and underachievers and the two groups were compared with respect to demographic and cultural data.

The conclusions from the comparison of data was that there were no significant differences between overachievers and underachievers with respect to age, sex, school, school grade, relationship to head of household, mother's or father's age, or number of siblings. The only significant variables found were that: a) overachievers' parents are more likely to be natives of the U.S. Virgin Islands rather than from the Continent, Puerto Rico or the British Virgin Islands; b) there is little difference in education between the fathers of the two groups of students, but the mothers' education differs significantly; c) overachievers tend to come from middle income rather than the higher or lower income groups; d) the families of overachievers tend to be more stable; e) fewer mothers of overachievers are working. A more intensive study of attitu-

dinal and related information substantiated the demo-cultural finding that over-achievers tend to come from more conformist families.

(2) Questionnaires and instruments were designed to be used in determining "what social, economic, cultural or other factors operate so as to have an interfering effect on the development and functioning of the intellect, and how such factors operate": A Census Interview, Student-Teacher School Questionnaire, and a Design-in-Depth Interview including intelligence tests, a psycho-neurotic inventory test and instruments to gather-in-depth information on the family and community structure were designed, but due to constrictions of time and administrative limitations were not used as originally intended.

(3) A mental retardation baseline study and neighborhood survey was completed on the basis of 675 interviews on the islands of St. Thomas and St. Croix. 452 people were interviewed on St. Thomas and 223 on St. Croix. Census interviews were carried out in nine communities selected at random, five in St. Thomas, four in St. Croix.

REMOTE SENSING TECHNOLOGY

The St. Croix Environmental Laboratory was opened early in 1969 for the purpose of "advancing the technology, methodology and analytical sampling with regard to space, earth and ocean sciences." It housed the three projects funded by NASA (National Aeronautics and Space Administration) and one project funded by the U.S. Air Force.

Background Paper No. 1

The first NASA project was Project #29, Life Detection Instrumentation, and its objective was the study of optimization of the separator sub-system for GX/MS life detection instrumentation. The final report of 1969 was entitled the same as the project's name. This project was followed by two additional NASA projects: Project #33, Lunar Sample Analysis and Project #34, Lunar and Planetary Spectral Reflectivity.

The objective of Project #33 was to utilize specially designed instrumentation to measure the light reflected from the lunar samples brought back from the moon by Apollo missions. Project #34 was to further develop new methods of analyzing the chemical composition of distant surfaces by measuring the reflected sunlight, and to investigate the spectral reflectivity properties of lunar and planetary surfaces. The publications that resulted from these projects were: "Spectral Reflectivity of Lunar Samples, " "Spectral Reflectivity and Compositional Implications," "Lunar Theory and Processes: Discussion of Chemical Analysis," "Lunar Theory and Process: Post-sunset Horizon Afterglow," "Remote Sensing of Lunar Surface Mineralogy: Implications from Visible and Near-infrared Reflectivity of Apollo II Samples," "Spectral Reflectivity of Lunar Samples," "Alteration of Lunar Optical Properties: Age and Composition Effects." Both of these projects were transferred to Fairleigh Dickinson University's West Indies Laboratory on St. Croix in early 1972.

Project #50, funded by the Air Force Cambridge Research Laboratory this project investigated the spectral characteristics of the terrestrial surface

and atmosphere in a tropical environment. It was completed in early 1972 and the final report, "Incident and Reflected Solar Radiation in a Tropical Environment," submitted.

In summary, these projects analyzed the lunar samples and attempted to further develop new methods of analyzing the chemical composition of distance surfaces by measuring reflected sunlight. Comparison of the spectral reflectivity of the lunar samples with earth-based telescopic measurements has led to significant new conclusions about processes on the lunar surface. A major interest of the Institute has been the possiblity of adapting remote sensing technology used in these projects to water pollution monitoring and control in the waters of the Virgin Islands and the rest of the Caribbean.

SOCIO-ECONOMICS

Even before the formal inauguration of the Institute, plans had been developed for the establishment of a Socio-Economic Research Unit. This was the Institute's initial research direction. Unfortunately, records of the earliest projects are not complete; for example, data from Project #1 (Economic and Geographic Study of Shifting Agriculture in the Guayana Region of Venezuela) and Project #2 (Social Research Planning Project) are not on file. The latter apparently included a final report completed in 1965, which contained social data needed for long-term health planning.

Project #3 (V.I. Corporation Future Plans) was designed to produce a program for development. A final report recommended projects in two basic

areas: 1) Inter-Island Tourism and Commerce and 2) Research and Experimentation in Agriculture and Applied Oceanographics. Project #17 (Sociological Study of a Public Housing Project in St. Thomas) was an interview survey of families in a St. Thomas housing project, which aimed to provide a range of sociological data to be used in connection with a federal pre-school education program (Project Headstart). However, again the files contain no data or records.

Agriculture

A general study of the agricultural development needs of St. Croix in line with a plan to phase out sugar-milling at end of the 1965-66 grinding season was initiated, and expanded to include a series of studies of all aspects of the problem to converting St. Croix agriculture from cane to alternative enterprises. The project, Project #9, terminated in 1966 and resulted in the following reports:

"Report to the Governor of the U.S. Virgin Islands on the Reconstruction of the Agricultural Economy of St. Croix."
"Housing, Land and Agriculture in St. Croix, U.S. Virgin Islands, the Urbanization of a Caribbean Island," "Cultural and Social Aspects of Agriculture in the Virgin Islands,"
"Survey of Hydroclimatology of St. Croix."

Two studies, the Economic Survey of Farms in St. Croix, and the Administration of an Agricultural Development Program were not completed.

Background Paper No. 1

In the "Report to the Governor of the United States Virgin Islands on the Reconstruction of the Agriculture Economy of St. Croix," (Blaut, Mark, & Dammann, 1965) it notes that, faced with a mission to address itself to the problem of short-term action designed to provide an alternative for cane farmers who, within ten months, would no longer have a market for cane, the study could do little more than delineate the problem. The report offered recommendations on 1) the need for reconstructing agriculture in St. Croix, 2) the immediate steps which could be taken to effection a transition, and 3) the areas which must be studied, rapidly and intensively, in order to have at hand a timely solution.

Faced with two alternatives after the demise of sugar, one an irreversible change from a predominantly rural, agricultural landscape to an urbanized or "suburbanized" landscape, the other diverse agricultural enterprises, the report recommended the latter. This conclusion was based on, briefly, 1) An adequate supply of undeveloped non-agricultural land for the demand for building sites; 2) That urbanization would radically alter the St. Croix landscape, which was a question not only of aesthetics but economics; 3) All urban properties will be enhanced in value if the island as a whole remains visually attractive; 4) Profitable agriculture achieves the same effect of beautification with an additional benefit of direct employment and income; 5) Agriculture lends socio-economic stability; 6) Profitable agriculture through domestic consumption emphasis will have the effect of reducing the insular cost of living; 7) St. Croix agriculture could provide islands food needs and

yet profitably export produce to the U.S., etc. on a small scale.

"Cultural and Social Aspects of Agriculture in St. Croix," (Rosenberg, 1966), concerned itself with farmer's attitudes and aspirations, and sought to determine the probable willingness of farm families to assume risks involved and remain in agriculture. The report concluded that, "The present farming population in St. Croix, consisting in general of those farming their own land, is one dedicated to farming, deeply involved and strongly motivated to the continuation of agriculture and the retention of the land acquired through much toil and difficulty." The report describes the farming population as "literate,...generally familiar with and receptive to modern technology...(most) represent a sort of "hard core"...determined to continue farming...(consider) ...marketing to be the primary problem or deterrent to increasing the land used for agriculture."

A St. Croix soil survey had been done in June, 1965 by the Soil Conservation Service which indicated the slope, soil moisture, soil capabilities of the island. A groundwater survey was also done around that time, but as of January, 1966 there had been no study of the hydroclimatology of St. Croix. It was to provide some rough indications of the areal differentiation of rainfall, annual and monthly rainfall variability, evapotranspiration and water deficit, that a group of research workers from Clark University were brought to St. Croix in mid-January, 1966.

The final report, "Survey of the Hydroclimatology of St. Croix,"

(Bowden, Allen, Andrew, Arey, Clark University, 1966), is a rough resume of data collected during a brief period of time and analyzed on the basis of speedy field and makeshift techniques. It did, however, precipitate a later comprehensive report on Virgin Islands water balance by Bowden.

Inter-Virgin Islands Relationships

In 1968 the Virgin Islands Inter-Relationship Program was initiated. The study explored the relationship between the United States and the British Virgin Islands on the thesis that, although separate political entities, the two form a well-defined geographic, linguistic, ethnic and socio-economic unit. The project, funded privately, sought to identify the factors which led to this relationship, and the problems to which it has given rise.

Following 18 months of study, a report, "A Study of the Inter-Relationships between the British and United States Virgin Islands," was completed. The most important aspect of the study derives from the fact that it represented the first comprehensive attempt to look at the Virgin Islands as an ecosystem and it concluded after examination of all available data that:

(a) Political integration will raise large and difficult substantive issues. As a long term objective, however, it might well prove worthy of serious consideration even though some innovative approach may be found to be necessary;

(b) It would appear desirable that the realities of the degree of socio-economic integration which has so far been attained should

be carefully examined with a view to determining the feasibility of closer association of the islands on an institutional basis. Since the islands should have much to gain from cooperation and complementary rather than competitive programs, operational integration would seem useful in many and urgent in some areas.

This study is being updated for publication.

As a direct result of the finding of the aforementioned study, the project was extended from September, 1969 to December, 1971, and was partly conducted at the Institute and partly at the Center for International Studies at the University of Pittsburgh. The objectives were:

(1) To provide information for the islands about themselves; (2) To provide information for each group about the other; (3) To provide information for other publics about the islands. Since a fairly substantial amount of literature was available on the U.S. Virgin Islands, substantial emphasis was paid to the British Virgin Islands about which very little had been written. The outcome may be summarized as follows:

(a) Magazine Articles

"The British Virgin Islands: A Conservation Perspective," (Harrigan, Environmental Newsletter, 1970). "The Inter-Virgin Islands Conference," (Harrigan, Carib, 1971).

(b) Journal Articles

"A Profile of Social Development in the British Virgin Islands,"

(Harrigan, Caribbean Studies, 1971). "Anegada-Feudal Development in the Twentieth Century?" (Harrigan & Varlack, Caribbean Quarterly, 1971).

(c) Books

The British Virgin Islands - A Chronology (Harrigan & Varlack, Research & Consultant Services, Ltd., 1971); The Virgin Islands Story (Harrigan & Varlack, Caribbean University Press (forthcoming).

(d) Monographs

The Evolution of the Micro-State Political System (The Case of the British Virgin Islands), (Harrigan); The Inter-Virgin Islands Conference: A Study of a Micro-State International Organization (Harrigan); The Development of Education in the Virgin Islands (Varlack).

(e) Doctoral Dissertation:

"Higher Education in the Micro-State: A Theory of Raran Society," (Harrigan, University of Pittsburgh, 1972).

Four manuscripts dealing with government and education are still incomplete.

Cultural Ecology - The British Virgin Islands

Project #38, The Dave Hokin Foundation Research Fellowship in Insular Ecology, was in support of research activities of a pre-doctoral candidate pursuing the study of "The Cultural Ecology of Local-level Politics in the British Virgin Islands." The fellowship extended over a one year period, 196-1970.

Proposed was that:

(1) The study would provide data on community and inter-community economic, political, and associational networks.

(2) That the study be placed in a theoretical framework which is becoming increasingly useful in the course of Caribbean research, and that conclusions would be found following the study of political activity in those loosely organized communities typical of the British West Indies.

(3) The data gathered in the British Virgin Islands will provide information for other social scientists on a society that has received little attention from social anthropologists.

(4) The proposed project will serve as a pilot effort and a point of departure for related studies being planned and organized by the Department of Anthropology at Case Western Reserve University and the Caribbean Research Institute.

"The Cultural Ecology of Insular Politics in the British Virgin Islands: Political Adaptations to Poverty and Dependence," has been published as a doctoral dissertation.

WATER QUALITY

The Institute began conducting water pollution studies for the V.I. Government during the summer of 1969 when it undertook detailed analyses of the environmental factors at Cruz Bay, St. John and Chocolate Hole, St. John

as a base for recommendations for waste disposal and run-off controls for adjacent land areas. Since that time there have been 12 amendments to the original contract and a resulting 20 reports covering enclosed bays, two harbors, and sewage disposal practices and operating efficiences of package sewage treatment plants. The project, Water Pollution Studies (341), terminated in October, 1972.

Water Pollution Report No. 1 - "A Study of the Effects of Pollutants on the Waters and Sediments of Cruz Bay," (Brody, Griff, Raup, vanEepoel, 1969): Objective - To learn about the present distribution of sediments and bottom types; to infer the recent physical history of the Bay; to infer the short and long term effects of bottom currents and wave action. Summary - Cruz Bay is a small, relatively undisturbed area with healthy biota and water of generally high quality. However, the threat of degradation of existing conditions is present, with a large portion of the Bay showing signs of change towards a much less ecologically healthy environment due to a slow flushing cycle not rapidly removing drainage and raw sewage effluents. Recommendations - Reduction of domestic sewage effluent levels; a moratorium on dredging within the bay.

Water Pollution Report No. 2 - "Effects of Dredging in Water Bay, St. Thomas," (vanEepoel, 1969): Objective - To present data and conclusions resulting from preliminary investigations of the effects of dredging in Water Bay. Summary - It is clear that the bottom alteration in that year

had resulted in a major ecological disaster for the sub-littoral flora and sessile fauna. Relatively rapid extirpation of many of the corals, grasses, and algae are resulting from disruption, covering, or siltation, and the highly turbid water condition will continue to destroy more.

Water Pollution Report No. 3 - "A Study of the Waters, Sediments, and Biota of Chocolate Hole, St. John with Comparison to Cruz Bay, St. John," (Brody, Griff, Raup, vanEepoel, 1970): Objective - To collect basic information, i.e. water quality, benthic biology, and sedimentology, with an eye to comparison with the earlier study in Cruz Bay. Summary - The water of Chocolate Hole is of very good quality and comparable to that of other naturally undisturbed local bays. Recommendations - Strict control of development in that area to preserve high water quality; certain changes in Virgin Islands water quality preservation and pollution abatement: a) changes in water quality control criteria, and b) initiation of a program by the Department of Health (Division of Environmental Health) to locally compare results from standard sanitary bacteriological techniques to those from some of the marine organism culture techniques.

Water Pollution Report No. 4 - "Survey of the Ecology and Water Quality of Lindberg Bay, St. Thomas," (vanEepoel, Griff, 1970): Objective- Preliminary investigations through instrument and visual surveys in an attempt to describe the nature and extent of the power plant flume, and its effects, if any, on the local biota. Summary - Although on occasion unusually high water tem-

peratures have been reported from the area of the powerplant/desalinization plant outfall, temperature and salinity measurements indicate the qualities of the plant effluent make slight difference in the receiving water. However, it is not known if effluent quality is consistent. The destructive factor is evidenced that over a large portion of the bay sustained high levels of suspended and settleable terrigenous solids, causing turbidity and siltation, are of much greater damage to the overall ecology of the area than thermal pollution. Recommendations - Unless steps are taken to abate runoff, the quality of the water and marine life in Lindberg Bay will continue to deteriorate and it may eventually be undesirable as a swimming beach.

Water Pollution Report No. 5 - "Effects of Dredging at Great Cruz Bay, St. John," (vanEepoel, Griff, 1970): Objective - To present data, conclusions and recommendations resulting from preliminary investigations of the disturbances produced by dredging activity in Great Cruz Bay, St. John. Summary - Great Cruz Bay supports a typical and well developed algal-grass pasture over the majority of its area, with only limited coral development occuring in narrow areas along the northwestern and southwestern shores. However, present dredging operations are releasing large amounts of fine solids which experience has shown can remain in suspension over a year. Extreme turbidity has reduced, by as much as 89% in some areas, sunlight reaching bottom. Opinion is that dredging permit indefensible destruction of a natural resource, and operates against the best interest of the territory. Recommendations - That the permittee be required to pond and contain the dredge discharge so that a

much cleaner effluent is returned to the bay; that the air release devices be controlled to minimize the discharge of silt/water.

Water Pollution Report No. 6 - "Preliminary Study of Sewage Disposal Practices in Areas not Served by the Public Sewage System of Charlotte Amalie," (Reynolds, Clark University, 1970): Study based on work of eight undergraduate students from Clark University, who operated under the partial aegis of an agreement between CVI and the Department of Health. They participated in a three-week period multidisciplinary program. Objective - Preliminary survey of sewage disposal practices on St. Thomas with particular focus on areas not served by the public sewerage system. Summary - Limited field and laboratory study of 10 treatment plants; reuse aspect of package treatment plant operation requires further study; facilities for regulating the development and operation of plants appears inadequate; approximately 190,000 g.p.d. of raw sewage probably introduced into waters of marinas and anchorages in St. Thomas during height of tourist season.

Water Pollution Report No. 7 - "The Status of the Marine Environment at Water Bay St. Thomas," (Griff, vanEepoel, 1970): Objective - To summarize observations on the progression of changes in the quality of the water and sessile benthic communities during a dredging period which extended from 1969 to 1970. Summary - Dredging has done considerable damage to bottom organisms, and in addition to live forms being destroyed by actual removal as part of the spoils, all the reef organisms in the bay have been adversely affected.

Continued dredging would further stress an already hard-pressed environment. Recommendations - No further dredging in bay and dredging outside bay to continue with all available safeguards.

Water Pollution Report No. 8 - "Water Quality and Marine Environment of Vessup Bay, St. Thomas," (Grigg, vanEepoel, Brody, 1970): Objective - To assess the water quality and to develop a general description of the marine environment. Summary - Bay shows ill effects from human activity. Recommendations - Controlled development in Red Hook area encouraged, with marina development in Benner Bay curtailed; V.I. Government should designate the area as the small vessel harbor and marina for eastern half of St. Thomas and plan controlled harbor development; the southwestern half of Vessup Bay should be deepened to a depth of about 10 feet; effluents from sewage treatment facilities should not be discharged into bay.

Water Pollution Report No. 9 - "The Status of Water Quality in Cruz Bay and Chocolate Hole, St. John," (Grigg, vanEepoel, 1971): Objective - A follow-up evaluation of Chocolate Hole and Cruz Bay based on quantitative data collected in late 1970. Summary - Cruz Bay water quality on the whole is worse than a year ago, however, noted is a relative improvement in the quality of the creek water. Presently it seems likely that most of the change is due to seasonal wave action, which has disturbed bottom sediments in the outer bay.

Water Pollution Report No. 10 - "Water Quality and Environmental

Background Paper No. 1

Status of Benner Bay - Mangrove Lagoon, St. Thomas," (Griff, vanEepoel, Brody, 1971): Objective - To describe the Benner Bay - Lagoon environment, primarily the water quality. Summary - Development on the east end of St. Thomas is increasingly geared toward water oriented facilities, with the resulting danger of poor water quality due to impoverish biota as a consequence of exhaust gases and unburned hydrocarbons being continuously injected into water at higher than ambient temperatures and pressures, plus sewage, miscellaneous refuse and oil spillage. The area is one of diversity, not only of habitat types but in the degree of anthropogenic destruction throughout the area. Benner Bay is biologoically devastated; water quality and natural systems are less affected to the west and improve rapidly toward the south. Environmental stresses are increasing from expanding development in Nadir and Bovoni and as far away as Tutu. The southern section of the Lagoon and its reefs and grass flats remain superb examples of shallow tropical reef and marine pasture systems. Data collected suggest this area one of very high net productivity. Recommendations - The local government should come to a decision on the use to which the Mangrove Lagoon is to be put, as the present course of development in and around the area increases pressures daily on this unique ecosystem. Marina development should be confined to Benner Bay and any extension should be east rather than westward. No dredging should be allowed outside Benner Bay. The government should acquire the necessary land on Long Point to include at lease all of the eastern slopes for designation as a V.I. Coastal Zone Preserve. The Nadir sewage treatment plant should be

made to operate close to optimal. The proposed horse racetrack should not be placed close to the shore, but should be located far enough west to allow for a green belt between it and the shore to act as an ecological buffer zone.

Water Pollution Report No. 11 - "Water Quality and Sediments of Lindberg Bay, St. Thomas," (vanEepoel, Brody, Griff, Raymond, 1971): Ojective - Presentation of additional observations, samplings and measurements made in the summer and fall of 1970 and winter of 1971, due to concern over deteriorating water quality. Summary - Turbidity has increased markedly over the past few years. The seaward sill-shoreward basin combination left by the dredging effectively blocks the needed flushing and acts to trap much of the fine material entering the bay. The natural biological communities of the bay have been catastrophically altered. Water quality is markedly reduced, with sewage pollution a notable factor. Discharge of heated, hypersaline effluent has produced observable effects. Recommendations - Drainage of rainfall runoff into the bay should be eliminated; a surface or sub-surface-rubble breakwater should be constructed to run from Range Cay to the west end of the airport runway. Restoration of water quality and development of the full recreation potential of Lindberg Bay should be assigned top priority on the list of possible restoration projects on St. Thomas. Immediate initiation of a project to design restorative procedures for Lindberg Bay should be effected. Effort should be applied to eliminate sewage discharges into the northwest corner of the bay. Surveillance of the bathing beach water quality would be prudent and research is recommended to investigate the effects of high con-

centrations of sewage organisms and nutrients on the ecology of the shallow Virgin Islands' bays and nearshore areas. A project should be initiated immediately to measure some effects of the discharge research is needed to investigate the effects of heated and/or hypersaline waters and higher concentration of copper, iron and nickel on the shallow water benthic tropical marine communities.

Water Pollution Report No. 12 - "Operating Efficiencies of Package Sewage Plants on St. Thomas, V.I.," (Griff, Shatrosky, vanEepole, 1971): Objective - Sewage treatment practices in the V.I. pose several interesting problems because of the diversity of treatment methods used, and the influence of peculiar local factors. This study was primarily to monitor the operating efficiency of 12 treatment plants on St. Thomas. Summary - The study revealed that the degree of sewage treatment plants vary widely (an 80% or better reduction in B.O.D. is achieved as frequently as 92% of the time (Crown Colony) and as infrequently as 33% of the time (Lime Tree Hotel).

Water Pollution Report No. 13 - "Decentralized Water Reuse Systems in a Water Scarce Environment: The Tourist Industry in St. Thomas, Virgin Islands," (Kasperson, Clark University, 1971): Objective - This report continued a relationship between Clark University and the U.S. Virgin Islands directed at research on environmental problems. The study determined to gather basic data on water consumption and sewage disposal facilities at major tourist establishments in St. Thomas. Data were analyzed with specific intent

of providing some rudimentary indications of the feasibility of water reuse systems outside the limits of Charlotte Amalie. Summary - While a preliminary effort, results indicate the key role played by water supply in the investment and operating costs of resort complexes, particularly in those areas distant from Charlotte Amalie. The data gathered indicate that substantial economic savings are possible through water reclamation.

Water Pollution Report No. 14 - "Operating Efficiencies of Package Sewage Plants on St. Thomas, V.I.," (Grigg, Shatrosky and vanEepoel, 1972): Objective - Analysis of the operation efficiency of 15 treatment plants on St. Thomas during period January 1 - June 30, 1971. Summary - Most of the plants were operating better during this period than during the last reported period (August-December, 1970). Of the total, most showed improvement with three operating less favorably than before. Regular and adequate chlorination of effluents at most plants is not generally accomplished and is strongly recommended where there may be contact by man or higher animals.

Water Pollution Report No. 15 - "Marine Environment of Brewers Bay, St. Thomas, V.I. with a Summary of Recent Changes," (Grigg, Crean, van-Eepoel): Objective - To determine effects of dredging in the bay between July, 1970 and September, 1970. Summary - Observations of the benthic flora and fauna in the bay were made, plus the characteristics of the beach, and environmental parameters were monitored such as temperature, salinity, water transparency and suspended solids. The prevailing water clarity is

probably not as good as it should be. Recovery of water clarity in Brewers Bay was rapid, however, compared to other local bays which have been dredged. The latter is judged to be due to its wide, open crescent shape and the slow but constant drift of the westward littoral current which allows for better flushing. Turbidity remains extremely high and visibility is only a few feet in the holes up to 40 feet in depth in one portion of the bay.

Water Pollution Report No. 16 - "Environment, Water and Sediments of Christiansted Harbor, St. Croix," (Nichols, Grigg, Sallenger, vanEepoel, Brody, Olmon, Crean, 1972): Objective - To address the questions posed by the harbor environment, to describe and inventory the "status" or distribution of the basic environmental elements of the harbor, its bathymetry, water and ecology, and to evaluate these elements in an interacting system and to interpret the environmental processes and responses in terms of potential changes that may affect continued use of the harbor and maintenance of its environmental quality. Summary - The harbor floor is shaped into broad shoals cut by a deep winding channel in the eastern sector. Most harbor shores are stable, but attractiveness of beaches is reduced by accumulations of marine grasses, beachrock, abandoned boats, and rubble. Water quality varies from excellent in the western harbor and seaward reaches to poor in the eastern and inner parts. Spatially, water temperature, salinity and dissolved oxygen vary within narrow limits. Harbor circulation is driven by the mass transport of ocean waves breaking on Long Reef. Althougg tidal exchange is insignificant, waters are rapidly flushed and mixed by the over-reef flow supplemented by wave motion. Bottom

sediments are predominately coral sand. Five sedimentary environments are recognized, and several biological zones identified. Certain combinations of wind and sea directions may effect a larger fraction of waste material fron Long Reef sewer outfall being swept back onto the harbor. An estimated 46% of the harbor floor has been directly or indirectly disturbed by dredging. The environment shows signs of faltering under the combined stress of pollution and utilization. Coastal shipping places the greatest demand on the harbor environment. Recommendations - Waste discharges and bottom and shoreline alterations, mainly dredging, must be held to a minimum. Areas of unique value and high environmental sensitivity should be designated as marine preserve or conservation areas. Investigation must be made into possible restoration of the central harbor. A comprehensive plan of development must be made to provide for the many diverse and conflicting future demands on the harbor, public and private, and still obtain maximum long-term socio-economic benefits. A series of dye studies should be conducted to determine the amount of effluent fractions transported back over Long Reef into the harbor.

Water Pollution Report No. 17 - "Operating Efficiencies of Package Sewage Plants on St. Thoms, V.I.," (Shatrosky, vanEepoel, Grigg, 1971); Objective - To present the results of the contineud analyses of the operations of packaged sewage treatment plants on St. Thomas during the period July - December, 1971. Summary - Among the 16 plants there are varying degrees of performance, and some improvements were noted. 9 achieved acceptable B.O.D. reduction (greater than80%) at least 90% of the time, but did not

consistently produce acceptable effluent quality. Those plants showing the greatest improvements were Estate Nadir, Limetree, and Shibui Hotel. We continue to be impressed by the potential health hazards concomitant with discharge of unsterilized effluents into receiving waters.

Water Pollution Report No. 18 - "Reconnaissance Survey of St. Thomas Harbor and Crown Bay, St. Thomas, Virgin Islands," (Percious, vanEepoel, Grigg, 1972): Objective - To do a reconnaissance survey of St. Thomas Harbor and to initiate a series of observations and measurement of the water, water exchange, and currents in St. Thomas Harbor and Crown Bay, the principal harbor area for the island of St. Thomas. Summary - Circulation and exchange of water in St. Thomas Harbor is primarily controlled by three factors: physiography, tides and wind driven surface currents. Operational problems with the recording current meter severely limited collection of channel current data, and channel water transport could not be quantified. Survey of salinity and termperature revealed vertical gradients with bottom water more saline and cooler than surface water. Average surface salinity affected seasonally, depth. Crown Bay water is clearly separable from East and West Gregerie Channel water. The contour plots of levels of dissolved oxygen, vertical and visibility, suspended solids, and fecal coliforms in both harbor and bay clearly shown the sources and distribution of contaminants introduced into the harbor waters.

Water Pollution Report No. 19 - "Status Report on Bays of St Thomas and St. John, Virgin Islands," (Griff, vanEepoel, 1972): Objective - To pre-

sent follow-up data and observations on seven bays previously studied and described over the past 3 years. To record changes in use patterns of the bays and surrounding shorelines as well as environmental changes. Summary Data and observations are given on Water Bay, Vessup Bay, Brewers Bay, Cruz Bay, Great Cruz Bay, Chocolate Hole. Care should be exercised in reaching conclusion about apparent changes in environmental parameters reported. In some cases the duration and intensity of certain changes, i.e. turbidity, are sufficient to indicate a real long-term change, others may be temporarily or seasonal.

Water Pollution Report No. 20 - "Operating Characteristics of Package Sewage Plants on St. Thomas, V.I.," (Shatrosky, vanEepoel, Grigg, 1972): Objective - To present the continued analyses of the operation of St. Thomas package sewage treatment plants on St. Thomas. Summary - Data given on 19 treatment plants and water quality characteristics described of Fort Mylner, Turpentine Run. Improvements are noted in most of the plants with the exception of Lime Tree Hotel and Indies House. Fort Mylner plants still very bad. Four of the nineteen plants, Bordeaux, Cowpet Bay #1, Crown Colony, and Shibui met the criteria for acceptable operation on 100% of tests. Noted are discharges that still are not being chlorinated.

In addition to water quality investigations, the Water Resources Laboratory activities included the initiation of an educational program for selected employees of the V.I. Department of Public Works on water pollution and the

operation of waste water treatment plants. 15 Government employees participated in the project, supported under a federal government grant from the Manpower and Training Division of the Environmental Protection Agency's Water Quality Office. By the terms of the contract, the Institute agreed to plan, develop, conduct, supervise and evaluate a program of instruction designed with a comprehensive approach to waste water treatment control for Virgin Islands needs. (Project #55).

The College also signed a contract with the Department of Public Works for Institute consultation, collection, and testing of waste water samples from V.I. Government-operated treatment plants on St. Thomas, St. John and St. Croix in order to monitor the operation of the facilities. (Project #54).

Harvey Alumina

The Harvey Alumina plant on the south shore of St. Croix processes about 2,100 tons of bauxite ore per day by a cuastic digestion process, yielding 1,000 tons of pure alumina. In addition, the plant produces its own electricity and potable and process water - about 1 million gallons a day - from a power/desalting plant. The wastewater from these processes includes 4.5 million gallons of cooling water and waster brine, discharged at above ambient temperature and with some added dissolved and occasionally, suspended solids.

The project, Harvey Alumina Thermal Study (#56), was to describe and delineate the thermal plume and the distribution and abundance of the marine benthic macroorganism communities in the project area, and to furnish baseline

data on the sublittoral flora and sessile fauna adequate for planning further investigations as required and adequate for future comparisons to other undisturbed inshore areas on the south coast of St. Croix. No attempt was made to determine or comment upon the relative health or comparative status of the communities described.

The final report of the project, "Water Quality and Benthic Biology within the Thermal Plume from Harvey Alumina, V.I. Plant," (Grigg, van-Eepoel, 1972), noted that assessment in this area and the assignment of causes is difficult since thermal and ionic anomalies and periodoc escape of solids attend the Alumina plant discharge, the area has been subjected to extremely heavy turbidity and siltation throughout the past five years from several sources: dredging, municipal dump, trenching.

The report summarized that the area is subjected to hot water discharge from the alumina plant and to suspend solids from several sources. Data on water quality obtained were: water depth, suspended solids, D.O. (MG/L and Saturation), Secchi Disk Depth. In addition descriptions are given of sublittoral plots, benthic plants, and the macrofauna of the survey area. Water depths are at most 2.5 meters and the bottom is coarse with one exception. Suspended solids in the surface water are high, and higher still in the bottom water. Transparency of water varied from 1.2 meters to less than 0.2 meters. The plant discharge water is clear except for periodic instances when operational problems allow the escape of large amounts of solids. Dissolved oxygen

in the surface water is high and was near or above the saturation point in all cases. The diversity and abundance of benthic plants varies greatly with distance from the discharge point and the dump. The immediate bottom area of the outfall is bare; macrofauna, including fish, were conspicuously rare in the entire area surveyed.

APPENDIX III

Background Paper No. 2

Ecological Research in the Virgin Islands: Historical and Administrative Background

O. Marcus Buchanan
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April 24, 1973

Background Paper No. 2

ECOLOGICAL RESEARCH IN THE VIRGIN ISLANDS

Historical and Administrative Background

This paper is intended to provide for a general introductory background theme to the topic of "Reseach Needs in Ecology in the Virgin Islands", one session of the Research Needs Conference, a multi-disciplinary effort, sponsored by the College of the Virgin Islands through it's Caribbean Research Institute, and being held at the College, St. Thomas, Virgin Islands, 24 April 1973.

In this discourse I am restricting my definition of the word "ecology" to the traditional definition used by biologists; that is, a study of the relationships of plants and animals to one another and to their environment. I do not intend to provide background discussion upon those broader, and more lately popular, definitions which in fact would preclude a comprehension of the sum total of environmental influences, thus breaching several of the other topics of this conference.

This paper is also not an attempt to examine in depth what has already been accomplished in ecological research in the Virgin Islands; such would merely be redundant, for this technical information is already in command and use by those participants at this Conference. For those readers who may not have a background on such research, there is no quick and easy reference; excellent starting points, however, are the various Reports of the New York Academy of Sciences (1913 - et sec); Miss Enid Baa's monograph on disserta-

tions and thesis on Caribbean topics (1969); and, the Reports of the Caribbean Research Institute.

My objective, rather, is to demonstrate in a broad manner the status of ecological research in the Virgin Islands at the present time, with particular regard to those factors of it's historical development, it's perspective within the West Indies, and it's current administrative status, which latter eminently governs it's immediately future development.

Historical and Perspective Background

The Virgin Islands are, today, an anomaly with regard to ecological research in the West Indies. It is important to understand the causative factors behind this situation in projecting the ecological research needs of these islands.

Located geographically in the east-central part of an archipelago of islands extending from Trinidad and South America to Florida and the Yucatan Peninsula, the Virgin Islands are biologically, as well as socially, ethnically, and geographically, West Indian and Neotropical. That their political and economic structure is not a part of this regional scene is rather an artifact of history than a result of natural regional associations.

The biota of the Virgin Islands shares with those other islands of this archipelago common affinities of origin, systematic relationship, evolution, and adaptation. This relationship parallels, with differing origins, the evolution of the present human population of the West Indies.

Background Paper No. 2

Our biota has, as a result of the human influence, been subject to those same changes that have effected plant and animal communities on each of the other West Indian islands. While some of the reasons for these changes are peculiarly West Indian, most are typical of the same changes that have occured throughout the world tropics, and in particular on tropical islands.

The questions relating to the nature and degree of these changes, and the effect that they have on the present and future inhabitants of these islands, not only with their biota but also with themselves, is the motivating factor behind much of the endemically-originated ecological research in the West Indies.

The anomalous status of the Virgin Islands with regard to ecological research arises from the fact that, with notable exceptions outlined below, little such research has been endemically-generated. In this aspect, the Virgin Islands differ startingly from their sister islands in the West Indies. They represent, in fact, a situation comparable to that of other West Indian islands a generation or more ago. The Virgin Isalnds are distinctly behind their other West Indian neighbors in ecological awareness. This situation appertains only today in the adjacent Commonwealth of Puerto Rico.

The present United States Virgin Islands have, for over 250 years, been under the federal control of two continental governments: The Republic of Denmark and the United States of America. This control, in fact, parallels that which was exercised on other West Indian islands in the past, and today is also the case in Puerto Rico. However, in terms of ecological research if in

no other fields, such parallels do in fact end.

The remaining West Indian islands were, for the most part, under the control of external governments that had established a heritage of interest and a precident for research in a natural history; a heritage that was ultimately in greater or lesser degree passed on to the peoples of their islands. Great Britain, the Netherlands, France, and to a lesser degree Spain, were all such nations.

In case any of the participants at this Conference are unaware of the impact which such colonial actions in fact had in the West Indies, I would demonstrate in point the development of such a heritage in the former British possessions. Britains were, and are, by nature naturalists: In their colonies in the New World tropics, as elsewhere, they early established formal clubs promoting the study of natural history; they established botanic and agricultural research stations; and they not infrequently established viable and often still extant small natural history museums. In the West Indies, such institutions were established on St. Vincent in 1763, Trinidad in 1820, Guyana in 1879, Grenada in 1886, Dominica in 1891; other such institutions existed on Jamaica, St. Lucia, and Antigua by 1907 (Aspinal, 1907). The Royal Victoria Institute Museum and the still eminently viable Trinidad Field Naturalists' Club were both founded in 1892. In 1922 the Imperial College of Tropical Agriculture, now the Faculty of Agriculture of the University of the West Indies, was established at St. Augustine, Trinidad. I.C.T.A. played the most important role in the Carib-

bean in the training of essentially applied ecologists in agriculture, entomology, botany, silviculture, and soil science.

The Dutch established similar facilities on Curacao, and later a formal research station, as did the French on Guadeloupe.

This background of governmental interest in natural history helped form the basis of a heritage on those islands today for the basic subject matter that now comprises ecology. While it is true that the primary political and professional motivation behind the establishment of most of these facilities was improved agriculture, these organizations in fact served as a regional locus for research in a wide variety of biological topics. A significant part of the functions of such establishments was the attraction to them of visiting biologists, thus infusing the local naturalists with current concepts and tending to break down insular barriers to new knowledge.

This lack of a heritage for ecological studies in the United States Virgin Islands is clearly due to the absence of such viable research organizations and educational and social institutions until very recent years. The reasons for this would appear to be the post-emancipation emphasis by both the Danish and the United States governments upon non-agricultural economics, commerce, and later tourism. It is in fact the recent emphasis upon tourism that has to no small extent provided the germ of interest in ecological studies in these islands.

Without such a heritage, it is not surprising that most applied as well

as basic ecological research in the Virgin Islands prior to the early 1960's was conducted by commuter scientists. In turn, this lack of heritage upon the part of the local community has made it sometimes difficult to press forth the need for endemically originated ecological research. In this regard, the transcription of ecological needs based upon temperate-zone continental concepts, popular during the past decade, into an essentially West Indian social community has been merely confusing.

The Virgin Islands need a regional and local ecological identity, an identity that will ultimately provide for heritage. The structural basis for the establishment of that identity is now present.

The Basis for Current Ecological Research in the Virgin Islands

Four primary events marked the basis for current interest in ecological research in the Virgin Isalnds. Those events were:

1) The establishment of the Virgin Islands National Park for the most part on the island of St. John, 1956.

2) The opening of the College of the Virgin Islands as a territorial institution of higher learning, 1962.

3) The establishment of the Virgin Islands Ecological Reserach Station, 1965.

4) The vitalization of research by the Bureau of Fish and Wildlife, Department of Conservation and Cultural Affairs, 1970.

I shall discuss the role of these units separately. For the moment, however, it is pertinent to point out that the primary impetus for the establishment of the research elements of these organizations was the scientific "crisis" which faced the United States in the late 1950's, and the consequent large amounts of federal funds that became available for such programs. Without that funding, it is exceedingly doubtful if ecological research in the Virgin Islands would have progressed beyond the individual inquiry stage.

The College of the Virgin Islands.

The College of the Virgin Islands was established in 1962 to provide for post-secondary school education in the Virgin Islands. It has progressed through two-year Associate to four-year Baccalaureate programs, and is now a territorial Land Grant Institution. To provide for a broad liberal curriculum, a Division of Science and Mathematics was established, including a resident faculty in the biological sciences.

Primarily a teaching institution, the College shortly after founding established a Caribbean Research Institute within its administrative framework, with the object of the Institute acting as the research arm of the College. The Institute is in concept a multi-disciplinary organization, and includes the Virgin Islands Ecological Research Station within its administrative jurisdiction.

Within the field of ecological research, the role of the College should be clear:

1) It provides through its faculty in biology and through the Caribbean Research Institute for the educational and experential training in ecology of regional students on the baccalaureate level. It is on this level, in fact, and not on the graduate level that the greatest paucity of ecological manpower exists today in the Virgin Islands.

2) It provides for the training of public school teachers in ecological subject matter, to better fit them, regardless of their academic backgrounds, for the needed interest which will ultimately lead to heritage in local students.

3) As a Land Grant institution, the College is now in a position to fill the local niche that has traditionally provided for the bulk of core research, both basic and applied, in the ecological sciences.

4) With the presence of the administrative (Caribbean Research Institute) and operational (Virgin Islands Ecological Research Station) structures for this research, the College is functionally prepared to undertake a wide variety of research programs.

Virgin Islands Ecological Research Station.

The Ecological Research Station is a unique research facility in the West Indies, in that it: (1) is administratively authorized to conduct ecological research on both terrestrial and marine habitats, and, (2) is by right of its location on the island of St. John logistically positioned to conduct such research literally in its own backyard. Further to this, is the fact that those habitats are protected by right of the presence of the Virgin Islands

Background Paper No. 2

National Park.

This facility is funded by an annual appropriation from the Legislature of the Government of the Virgin Islands, and is administered by the College of the Virgin Islands through its Caribbean Research Institute.

Logically, and by continental precident, this facility as a part of a Land Grant College should provide for the bulk of ecological research in the Virgin Islands. The history of the Station and its contributions have been clouded by administrative and policy problems. One major problem concerns the precise role the Station should play as a regionally funded and directed organization.

The Ecological Research Station has, in the past, supported the following kinds of programs:

1) Basic research on marine and terrestrial ecology, with a major emphasis on the former prior to 1971. For the most part, these studies have represented thesis or dissertation problems originated and conducted by visiting investigators, and funded by United States federal granting agencies.

2) Support for the Tektite I and II Projects (Collette and Earle, 1972, for technical studies). These were major, federally-funded, short-duration concentrated basic studies conducted almost exclusively by visiting investigators. Although the research conducted under these two programs was basic in motivation, much of the biological results have practical applications in the Virgin Islands.

3) Non-thesis graduate studies. The Ecological Research Station has served as a training ground in basic principles of tropical ecology for a limited number of selected graduate students from United States universities. While no specific research is usually conducted by these students, the students do act as a potential pool of future investigators with the advantage of previous Virgin Islands experience.

4) Applied research, which to date has been concerned with marine resources. Two signal projects were a study of the fisheries potential of the Virgin Islands (Dammann, 1969) and a spiny lobster management program (Olsen, 1972). Proposals have been submitted for a program of research on pollination and seed dispersal in Virgin Islands plants of economic and aesthetic important (Buchanan, MS).

5) Undergraduate field studies. These studies, basically pedagogic and experential in nature, have been seasonally conducted at the Station by groups from United States colleges and universities. There is great demand for the use of the Station facilities by such external groups, and there is serious contention as to what extent the Station should serve such purposes. There is no question that the Station could, and would be justified in serving such a useful role in undergraduate training at the College of the Virgin Islands; this has not been the case, however, because of course scheduling and the problem of inter-island logistics.

Background Paper No. 2

Department of Conservation and Cultural Affairs.

The Department of Conservation and Cultural Affairs is an agency of the Government of the Virgin Islands, headed by an appointed Commissioner, and possessing a Bureau of Fish and Wildlife with a professional biologist as Director.

The staff of the Bureau consists of a number of trained fisheries and wildlife management biologists. The Department is charged with the authority for the control, use, and management of the natural resources of the Virgin Islands not predisposed by United States federal authority. The Department is also concerned with the development and use of recreational facilities and with the cultural affairs of the island communities.

The Bureau of Fish and Wildlife is, in effect, an administrative and operational duplicate in general aspects of similar agencies in each of the various United States, and it has an authoritative parallel.

In terms of ecological research, the Bureau acts as an interpretive clearing house for the results of basic ecological research conducted in the Virgin Islands, and makes use of the results of such research in devising meaningful applied research programs conducted by its own staff.

Recent examples of applied programs conducted under the direction of the Bureau include food and sport fisheries studies, artificial reef design, mongoose ecology, a study of parasites of St. Croix whitetail deer, and pri-

mary support for the compilation of a popular handbook to the natural history of Puerto Rico and the Virgin Islands.

Virgin Islands National Park.

The establishment of the Virgin Islands National Park, administered by the United States National Park Service under the Department of the Interior, had a profound physical, biological, social, and economic effect upon the island of St. John, and to a lesser extent the other Virgin Islands.

Entirely aside from the very real social and economic changes wrought, the Virgin Islands National Park brought to the West Indies the concept of a major portion of a large island being under almost complete ecological control, with that control having its ultimate authority and administration from without the territory. From a historical standpoint, this represents a reversal of the general trend in the West Indies for greater territorial control, including that of natural resources. It is interesting to note that this same event coincided with the establishment of the Five Year Development Programmes leading to the independence of two major West Indian islands, Jamaica and Trinidad and Tobago, under which programs transferrence of authority for Crown Forest Lands and Reserves was made to the regional governments.

In terms of its meaning to regional ecological research, the Virgin Islands National Park has provided for the following:

1) It has reserved a large mass of lands and waters, comprising some 6,000 acres, where ecological disturbance has been reduced to a minimum.

The reserve includes reef and inshore habitats; mangrove swamps; cactus, arid thorn scrub, tropical deciduous, and some regenerating rain forest communities. No single reserve in the West Indies contains so many diverse habitats; it provides for a large natural arena for comparative ecological studies in the West Indies.

2) For the management of the resources of the Park, the National Park Service has devised a Management Resources Plan the bulk of which consists of problems which can only be answered by the application of ecological research. Provision for the funding for the execution of those projects by contract is in process.

In addition to these primary government-funded research organizations, there are three others which play a significant role in ecological thought, education, and research in the Virgin Islands. The Virgin Islands Conservation Society, Inc., a public non-profit society, is concerned primarily with the stimulus of ecological research and with education; it has recently concentrated on the publishing of popular tracts relating to such research. The Environmental Studies Program of the Department of Education is primarily concerned with the development of an ecological awareness upon the part of primary and secondary school students; in this sense, the Program plays a critical role in the initiation of interest leading to heritage in the natural sciences. The Island Resources Foundation, Inc., a private non-profit organization, includes significantly ecological research within the framework of its broader resource programs; it also serves as the headquarters of the

Caribbean Conservation Association, the regional West Indian conservation organization.

I am fully aware that I have not touched upon those several aspects of research that should, rightly, come within the scope of ecological research in the Virgin Islands. These include, for example, research conducted by the Department of Agriculture, the Soil Conservation Service, and possibly other agencies. They also include research conducted at the West Indies Laboratory of Fairleigh Dickinson University, St. Croix. I hope that those officials in these organizations will not feel that such omission is intentional; it is rather simply based upon my lack of information concerning their activies.

Discussion

It should be obvious from the data presented above that the Virgin Islands today have a large and diverse number of organizations within the operational structure of which ecological research is conducted. It is, in fact, a remarkable assemblage for a tri-island community comprising only some 70,000 inhabitants.

A major factor in defining the research needs of the Virgin Islands today lies in the need for a clear definition of the respective roles to be played by these now extant research organizations, and consequently the allocations of research programs.

The roles of the educational and conservation affiliates, the Environ-

mental Studies Program and the Virgin Islands Conservation Society, are already clearly defined. However, the relationships between the College of the Virgin Islands, the Caribbean Research Institute and Virgin Islands Ecological Research Station, the Bureau of Fish and Wildlife of the Department of Conservation and Cultural Affairs, and to a lesser degree, the United States National Park Service are less well-defined.

The need for definition arises out of the very real possibility of duplication of effort with regard to: (1) Overall research objectives; (2) Expenditures for facilities, equipment, and field work; and, (3) Utilization of available scientific manpower. Such overlap and duplication within the governmental structure of a community of islands such as these, with restricted fiscal and human resources, cannot easily be long tolerated. The restrictions of recent years in federal funds available for biological research of the kind needed in these islands makes this point abundantly clear.

With regard to the National Park Service, it is clear that there are policy decisions which to a great extent limit the use of their human, fiscal, and physical research resources to objectives which, in effect, are directly associated with the management of the National Park. To some extent there is a sharing of these resources between the Park Service and the Ecological Research Station, authorized through a Memorandum of Agreement between the Park Service and the College of the Virgin Islands. It is very doubtful that such a relationship would exist if the Station were located otherwise. This

is so because most of the research objectives of the National Park Service lie in the field of resource management, not in strict research which in fact is the reason for the existence of the Ecological Research Station.

It is clear that whatever formal research relationship that may exist between the Station and the National Park Service, will, under present policies, be limited to the execution of contract research by the Station for the Park Service. The limit to which this contract relationship exists should be defined. To a very great extent, however, those possibilities are severely limited by the National Park Service since they do not accept unsolicted proposals for research. This is an undesirable situation, considering the unique role played by the National Park within the community. That the National Park Service has made concessions in other aspects of the natural resources of the Virgin Islands National Park should give license for modification of policies which in effect are designed to cover continental Park management, and are not necessarily realistic in this insular community.

The research relationship between the Department of Conservation and Cultural Affairs and the Ecological Research Station is perhaps less well-defined than that between the Station and the National Park Service. That is, in fact, another curious anomaly of Virgin Islands bureaucracy, since the funding for the Ecological Research Station is provided by the Legislature through the Department of Conservation and Cultural Affairs.

As a generality, however, it may be stated that the logical research

functions of the Department of Conservation and Cultural Affairs should be those applied studies bearing directly upon natural resource utilization and management. Because of it's primary academic affiliation, the Ecological Research Station should be engaged in basic research and in the education and training of regional students in the ecological sciences.

There would appear to be an obvious need for circular allocation of projects, information, and perhaps human resources and facilities in this relationship. The parallel can again be made between Land Grant colleges in the United States and their state game and fish commissions: There exists as a general rule of rapport, if not an actual formal agreement, that facilities, services, and professional expertise will be shared, as needed, between the Land Grant institution and the conservation-oriented departments of the state government.

The establishment of a realistic working relationship such as this between the College of the Virgin Islands and the Department of Conservation and Cultural Affairs would clear the way for more meaningful coordination or research, avoidance of the possibility of duplication of effort, and possibly fiscal saving with regard to resources.

Each biologist working in the Virgin Islands is intimately familiar with the research needs within his field of study. Because of the relatively small number of scientists concerned, and because of the potential degree of informal communication afforded, there should be a general understanding upon the part

of each scientist of the principal ecological research needs.

However, because of the administrative barriers outlined above, and because a not inconsiderable amount of the ecological research conducted in these islands is in fact conducted by visiting investigators often without affiliation with these regional organizations, there is often a communications gap.

It would be in the interests of the various research organizations within the Virgin Isalnds to establish a regular open-discussion group for the systematic and periodic exchange of ideas and information on ecological research. The structure of such a group need not be formal, and it's published productivity might be limited to minutes. At the present time, such a group could, in fact, comprise the entire community of scientists engaged in ecological research in the Virgin Islands. The regular sitting of such a group, would allow for quick and easy dissemenation of ideas and information; it's funding, limited in scope, could be shared by the various agencies represented.

The features of insularity are the meat of the island ecologist; they are also the major deterrent to the projection of rational research programs endemically generated. Because of the lack of ecological heritage and tradition in the Virgin Islands, it is especially important that those persons charged with the conduct of ecological research communicate with one another.

This Conference is an initial step in attempting to establish that kind of cooperation and exchange of ideas.

Background Paper No. 2

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APPENDIX IV

Background Paper No. 3

Status of Research in the Virgin Islands Apropos of the Caribbean Area

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Bureau of Libraries and Museums
Department of Conservation & Cultural Affairs

April 24, 1973

Background Paper No. 3

An appraisal of research accomplished in and about the Caribbean region is both significant and informative. Every researcher or student, in whatever discipline, must know his basic literature, or must have immediate access to it. He not only needs to build up this mass of information over the years, but must be constantly abreast of the contributions in the several related fields, and must be critically selective in their use. This bibliographic wellspring must not only be comprehensive, but it must be current and immediate. The compilers must be knowledgeable and critical. Fortunately, with today's electronic gadgets, speed and accuracy of compilation is facilitated, but the bibliographer must keep ahead of the gadgets of reproduction in order to benefit the users who are researchers and scholars. In short, the researcher needs the assistance of the bibliographer, in addito his expertise in the particular discipline.

The Caribbean area is comparatively a small section of the New World, but it is intrinsically rich and ripe for research. The exceedingly small volume of studies produced to date reveal the almost pristine state of the art and should excite scholars, not only those just entering their fields of study, but also those already initiated, with a constant stream of subjects for study. The area is truly unresearched and rich in a variety and complexity that is unique beyond imagination.

Background Paper No. 3

In this age of rapid development, however, there is also a very real danger of loss and destruction of the essentials for study through neglect, abuse, and yes, most times, ignorance of the values and importance of these things which elude us in our mad rush into what is termed modern and necessary. The world of 'action' is inclined to belittle the world of the academician, yet these two worlds must not only have a symbiotic existence, but must be aware of their respective roles in this existence.

These preliminary reflections occured to me as I examined my compilation BIBLIOGRAPHY OF DOCTORAL DISSERTATIONS ON CARIBBEAN TOPICS published in 1969 by the Public Library in computerized (KWIC) edition, and again published in 1970 by the Institute of Caribbean Studies, Puerto Rico, entitled THESES ON CARIBBEAN TOPICS in conventional edition (Caribbean Bibliographic Series no. 1). This compilation was a leisure time avocation over a seven (7) year period and was accomplished without examination of the items listed. It was not intended as an exhaustive treatment of the subject, but only as a curious experiment to find out what was being done. It can be used to prove several aspects of the topic which this Conference aims at establishing today. In preparing this paper, I have also taken a representative sampling of supplementary materials under compilation to up-date the above work and soon to be published. The results of this sampling have been incorporated into the findings discussed in this paper.

Background Paper No. 3

Before entering into an evaluation of Caribbean Research, I have also taken a quick look at some standard bibliographic works which must be known to all Caribbeanists. These are: Cundall, Reid, Williams, Augier & Gordon, Horowitz, Crouse, Freyre, Lowenthal & Comitas, Tannenbaum and Norregaard. These are listed at the end of this paper. Their contributions in the total region are of general rather than specific nature, but important in the overall nature of the Caribbean.

The Virgin Islands' share of research is significantly small. First, this newly acquired United States Territory has been particularly vulnerable with respect to loss, abuse, destruction, ignorance, or indifference. For this reason, also, it is the area which is comparatively the least studied, while at the same time, in recent years, it is the area which is economically most potent compared to its area and population. There is an historic explanation for this seeming incongruity.

The entire Caribbean was perhaps the recognized springboard for New World colonization by the Old World. By discovery, Columbus gave to Spain a world to which, idealistically, Spain intended to extend her civilization, her religion, her culture and her language. We see this in her institutions which she established simultaneously with her government in each country--Santo Domingo, Puerto Rico,

Cuba, Mexico. France, another rival colonizing power in the Caribbean, also intended an extension of her culture, religion, language, etc., into the area, but was not quite so enthusiastic or idealistic in the establishment of cultural institutions as was Spain. The stalwart British took the lead in slave trading and still managed to institute their culture, religion and language into the West Indies. The Dutch too followed in similar fashion and left their indelible stamp in cultural institutions, government and language. The obvious results were the engendering of appreciation, national identity and loyalty, and a stable administrative policy patterned after the mother country, with recognition for educational levels, social institutions, such as archives, museums, universities, economic and industrial endeavors. The Twentieth Century has seen these one-time colonies develop into nations with an awareness of, and appreciation for, the well ordered policies, institutions, etc., of their mother countries. Moreover, there is a real sense of national origin and identity.

The U.S. Virgin Islands regrettably does not have this clear identification of loyalty, because, contrary to the situation of the rest of the Caribbean colonies, Denmark was unique in not attempting to extend wither culture, language, institutions, or stability of government in these islands. They were merely the outlet for her African slave

trading interests. In both the Gold Coast and the West Indian islands, she saw these as the essentials to her participation in the mercantilist colonial system and cared little about the colonies as such. In neither the Danish West Indies nor the Gold Coast do we find lasting evidences of the Danish institutions, culture, language, religion, etc. Meanwhile, there were strong policies at home and for officials abroad which were sacred to their national standards. There were no schools above the elementary level and no other institutions save the Church and the Bank. The obvious result is a lack of cultural heritage identifiable with the colonizing Denmark. Research is rendered somewhat prohibitive because of the Danish language (Gothic Script) despite the endless numbers of well-perserved Danish West Indian archives in the repositories of the Royal Archives, and the Royal University Library, museums, etc.

It is very important to emphasize here that the Danish Government, despite its colonial policy and seeming indifference to the colonies, have been meticulous in their records keeping. They had rigid, systematic methods of administration which allowed no infractions or outside interference, so that today I feel certain that all investigations in whatever discipline can be amply supported by official documentation, and much light can be thrown on life both in the Danish West Indies and the African Gold Coast.

Background Paper No. 3

Following the Danish period of indifference and distance, almost 300 years, there is a period of delirious fifty plus years of United States administration, shared between the United States Navy for 15 years and the Department of the Interior for the remaining forty plus years, during which there is yet to be established standardized control of official records and provide a suitable repository for these archives.

Scholars in this and future generations may not have resources on which to conduct research. Indeed, much has been destroyed and consequently forever lost to scholars. Social scientists, students of government, anthropologists, and educators will all deplore this flagrant indifference to administrative policies. Legislation without implementation is no panacea for this deplorable situation. Maturity and autonomy are expected to reflect a sense of time tested values for which there is no substitute.

From this historic backdrop, it is understandable then why perhaps the U.S. Virgin Islands (1917-) has had a slow start in the area of research. Interest in politics, economics, and social affairs is relatively recent. The establishment of a Junior College (1962) following thirty years after establishment of a senior high school was also long overdue. This delay is to be regretted since the economic climate was capable of providing such institutions

prior to the sixties, but with the United States mainland in the backyard, we can almost understand the complacency.

An examination of the status of research accomplished follows.

Of 1248 theses listed, I found that they were distributed according to the following disciplines:

	Caribbean (1248)	Virgin Islands (38)*
Agriculture	101	
Art & Music	14	1
Biography	23	1
Demography	12	
Economics	230	1
Education	143	4
Folklore	6	
History	102	6
International Relations	96	
Linguistics	46	1
Literature	52	
Medicine & Health	95	4
Natural Sciences	184	2
Politics & Government	173	9
Religion	31	
Social Sciences	223	9

Background Paper No. 3

*Universities at which Virgin Islands studies were accepted:

EUROPE

Denmark-Univ. of Copenhagen, 1903.	Biography
Germany-Univ. of Hamburg, 1934.	Geography
Univ. of Kiel, 1920, 1951.	Demography, Commerce
Univ. of Jenna, 1945.	Public Health
Karl Marx Univ., 1950.	Cultural Geography
England-Univ. of London, 1964.	Racial & Social
Cambridge Univ., 1950.	Anthropology
Edinburgh Univ., 1791.	Medicine

UNITED STATES

Columbia University, 1953, 1963, 1964, 1966.	Education, Music, Linguistics, Commerce
Univ. of Kentucky, 1955.	Politics & Government (Group)
Fordham Univ., 1942.	Education (Group)
Princeton Univ., 1959, 1962.	Geology
Univ. of Wisconsin, 1966.	Government (Group)
Univ. of Chicago, 1963.	Politics
New York Univ., 1964, 1968.	Education & Politics
American Univ., 1939.	Government
Tufts Univ., 1949.	Government & Politics, Colonial
Clark Univ., 1933, 1938.	Geography & Government
Yale Univ., 1906.	History
George Washington Univ., 1967.	Government
Cornell Univ., 1964.	Social Sciences
Univ. of California, 1917.	History
Howard Univ., 1957.	Nutrition
Harvard Univ., 1964, 1966.	City Planning
Univ. of Michigan, 1945.	Public Health
Georgetown Univ., 1962.	Government
Pennsylvania State Univ., 1961.	Nutrition

PUERTO RICO

Univ. of Puerto Rico, 1963.	Economics
Inter American Univ., 1968.	Labor

Background Paper No. 3

Universities at which Caribbean Studies were accepted (Listed by Country):

Canada	6	universities,	33	theses	accepted
*Costa Rica	1	"	1	"	"
*Cuba	1	"	1	"	"
Denmark	1	"	1	"	"
France	12	"	109	"	"
(Univ. of Paris accepted 70 theses of the 109 total)					
Germany	8	universities,	16	theses	accepted
Italy	1	"	1	"	"
*Mexico	1	"	1	"	"
Netherlands	7	"	31	"	"
Spain	1	"	4	"	"
England	13	"	240	"	"
(Univ. of London accepted 120, Oxford Univ. accepted 40 of the 240 total)					
Ireland	3	universities,	4	theses	accepted
Scotland	4	"	22	"	"
Wales	2	"	6	"	"
United States	86	"	807	"	"
(Columbia-121, NUY-45, Howard-40, Michigan-33)					
*Puerto Rico	2	universities,	35	theses	accepted

*These so marked indicate that there was the intention to compile a separate bibliography for these Caribbean institutions, therefore no effort was made to be comprehensive in listing these here. These few theses were picked up in passing & shows the urgency for the need of continued bibliographic control. An outstanding example is the theses

accepted by the Imperial College of Tropical Agriculture at St. Augustine, Trinidad, on which there is no record.

Caribbean Countries Represented in This Bibliography, of 1248 theses listed and supplement in preparation:

		Sampling from Supplement
Anguilla	2	
Antigua	6	
Aruba	6	4
Bahamas	25	4
Barbados	28	2
Barbuda	1	
Bermudas	12	
British Honduras	16	8
British Virgin Islands	3	1
British West Indies	101	27
Cayman Islands	1	
Cuba	109	19
Curacao	9	9
Dominican Republic	30	6
French Guiana	7	
French West Indies	32	
Guadeloupe	30	3
Guyana	29	12
Haiti	52	2
Jamaica	140	26
Martinique	32	
Netherlands Antilles	18	9
Puerto Rico	335	66
Reunion Island	1	
St. Bartholomew	1	
St. Kitts-Nevis	6	
St. Lucia	4	
St. Martin	1	
St. Vincent	3	2
Surinam	18	33
Trinidad & Tobago	72	16
U.S. Virgin Islands	38	5

The implications derived from sampling of the supplementary materials are quite clearly an indication of increased activity in the entire region, but also the continued lead which Puerto Rican studies seem to hold in all disciplines of

research. Surinam is also coming into the forefront, while Jamaica, Cuba, Haiti are steady. It must be noted here that much depends on the compiler's ability to get access to the tools for research as well as the time to devote to the job of compilation.

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One of the earliest and best.

Freyre, Gilberto.
THE MASTERS AND THE SLAVES. 2d English ed. rev. New York, Alfred A. Knopf, 1966.
Excellent bibliographic source.

Background Paper No. 3

Green-Pedersen, Sv. E.
THE SCOPE OF AND STRUCTURE OF THE DANISH NEGRO SLAVE TRADE. (Reprint from the "Scandinavian Economic History Review," vol. 19, no. 2, 1971, p. 149-197).
An excellent article with a new slant on Denmark. "The West Indian custom ledgers, audited in Denmark, indicate that the transit slave trade in St. Thomas continued at least until the English occupied the island at Christmas 1807. About all the copies of the Custom House books sent back to Denmark were discarded, but some pages containing company abstracts of custom revenues, etc., were generally torn out first."

Horowitz, Michael M., ed.
PEOPLES AND CULTURES OF THE CARIBBEAN, an anthropoligical reader. New York, American Museaum of Natural History, The Natural History Press, 1971.

Lewis, Gordon K.
THE VIRGIN ISLANDS, a Caribbean Lilliput. Evanston, Northwestern Univ. Press, 1972.
This lacks a bibliography, but should be critically and carefully read.

Lowenthal, D. & Comitas, L., eds.
THE AFTERMATH OF SOVEREIGNTY, West Indian prospectives. New York, Anchor Press, 1973.
Includes bibliography: p. 382-410.

Norregaard, Georg.
DANISH SETTLEMENTS IN WEST AFRICA, 1658-1850. Translated by Sigurd Mammen. Boston, Boston Univ. Press, 1966.
Includes extensive bibliography: p. 261-267.
Prof. Daniel McCall's "Introduction" to the English translation of Georg Norregaard's Danish Settlements in West Africa, 1658-1850 (1966) is an excellent scrutiny of the Danish-African-West Indian situation, and gives numerous important bibliographic citations.

Ragatz, Lowell Joseph, comp.
A GUIDE TO THE STUDY OF BRITISH CARIBBEAN HISTORY, 1763-1834, including the abolition and emancipation movements. Wash., D.C., Government Printing Office, 1932.
Excellent source book--based on materials in 69 repositories, both public and private, in 7 countries: U.S., Canada, Great Britain, Jamaica, France, Belgium & Switzerland. Compiled over a period of 11 years, and examined all but 14 items included.

Background Paper No. 3

Reid, Charles F., & others, eds.
BIBLIOGRAPHY OF THE VIRGIN ISLANDS OF THE U.S. New York, H. W. Wilson, 1941.
Good basic source book.

Williams, Eric, comp.
DOCUMENTS OF WEST INDIAN HISTORY. (Vol. 1, 1492-1655). From the Spanish discovery to the British conquest of Jamaica. Port of Spain, Trinidad, PNM Publishing Co., 1963.

APPENDIX V

Background Paper No. 4

Status of Educational Research in the U.S. Virgin Islands

Peter Rasmussen
Division of Planning, Research & Evaluation
Department of Education

April 24, 1973

Background Paper No. 4

Introduction

This Research paper is an outcome of the C.V.I. Caribbean Research Institute, Acting Director, Dr. Norwell Harrigan requesting a paper to be presented by the Department of Education to emcompass the following areas:

I - To state what research has been done.
II - To determine what research needs to be done.
III - To ascertain what resources are available to do the needed research.

Due to limited available time, the following procedures were chosen to gather the required information to fulfill the previously mentioned requirements.

1. A memorandum was distributed to all administrators and principals in the Department of Education requesting them to contact the Division of Planning, Research & Evaluation and relay any known information of research that has been done on education in the Virgin Islands, or is presently being done by someone.
2. Informal meetings with individuals and phone calls seeking their assistance in this task.
3. Two meetings with Miss Baa - To whom I wish to express thanks for finding time within her extremely busy schedule.

Background Paper No. 4

4. Visits to the V.I. Public Library.

The determining of what research has and needs to be done in education will become a continuous process within the Division of Planning, Research & Evaluation. This paper is not complete in its comprehensiveness, but it is a start to be improved on in the future. The Caribbean Research Institute must get credit for introducing a deadline for this product, or it might have been delayed in its implementation stage.

The Division of P.R.E. would welcome suggestions for the improvement of this product in order to enhance its comprehensiveness.

I. RESEARCH THAT HAS BEEN DONE

It is a curious irony that neighboring Puerto Rico has been analyzed in almost every imaginable areas by researchers, while the Virgin Islands has been significantly neglected.

The following studies are based solely on education in the Virgin Islands, although it is common knowledge that education overlaps any topic. The studies are listed by author's name, title of study or what was investigated, and date completed. The purpose of this section is to list the studies and not details on their findings or conclusions.

Background Paper No. 4

1. Dickenson - Ryan - Williams
Report on the Educational Survey of the Virgin Islands.
1928

2. Whitehead, Henry S.
Negro Dialect of the Virgin Islands.
American speech - Baltimore Vol. 7, No. 3
1932

3. Reid F. (Prepared with Assistance of the Fed. Works Agency)
Bibliography of the Virgin Islands of the U.S.
H. W. Wilson Company
1941

4. Anttilia, Earl,
U.S. Educational Policy in the Caribbean
Puerto Rico & Virgin Islands
University of Texas
1953

5. Bailey, Beryl, Loftman,
Creole Language of the Caribbean
A comparison of the grammar of Jamaican Creole, with those of the creole languages of Haiti, the Antilles, the Guianias, the Virgin Islands and the Dutch West Indies.
Columbia University
1953

6. Robinison, William,
A Study of the Instructional Personnel in the Public Schools of St. Thomas, U.S. Virgin Islands
Hampton Institute
1954

7. Kunzer, Edward J.,
Study of Off-Island Training of High School Students
Mimeographed
1957

8. Thomas, Neville,
A Study of College Preparatory Course Graduates from the Public High School in the Virgin Islands (1955-60)
1960

9. Government of Virgin Islands,
The Governors Conference on Higher Education for the Virgin Islands
Establishment of C.V.I. (held at Bluebeards Castle)
1961

Background Paper No. 4

10. Center for School Services - School of Education N.Y.U.
The Virgin Islands Comprehensive Surveys - Completed at the request of Commissioner of Education.
An educational survey of the Virgin Islands school system concerning present status and future outlook.
N.Y.U.
1963

11. Wood, Marie,
A Teacher Education Project,
Hampton Institute on-Island Programs '53-63'
Hampton Institute
1963

12. Rowe, Richard: & Thorndike, Robert L.
Virgin Islands Intelligence Testing Survey,
Institute of Psychological Research, Columbia University
1963

13. Dalton, Robert H.,
Mothers and Children
A study of parent-child relationships in St. Thomas, V.I.
Dept. of Health
1963

14. Fill, Herbert, J. & Segal, Erwin,
Teacher-Child-Parent Inter-Relationships in the U.S. Virgin Islands,
Report presented at the Forth Caribbean Conference for Mental Health in Curacao
Dept. of Health
1963

15. Bornn, Hugo O.,
Resources for a Program of Music Study for the Elementary Classroom Teachers of the Virgin Islands
Columbia University
1964

16. Dejnozka, Edward, J.,
First, Second, Third Report on the Virgin Island N.Y.U. Project - Upgrading the Educational Quality in the U.S. Virgin Islands.
N.Y.U.
1966

17. Benden, John S.
A curriculum Umbrella for the U.S. Virgin Islands Schools

Background Paper No. 4

A study of administrative responsibility for school curriculum.
N.Y.U.
1966

18. Division of Vocational Education
"A Study to Determine which Area of Instruction at the Senior High Level are the Most Student Concentrated at the Charlotte Amalie and Christiansted High Schools"
Dept. of Education, V.I.
1966

19. Division of Vocational Education
"Supplementary Report on the Business Education Curriculum at the Charlotte Amalie and Christiansted High School"
Facts on ratio of pupils considering business education.
Dept. of Education, V.I.
1966

20. Wallace, Vitalia L.
Recruitment Problems in the U.S. Virgin Islands
Dept. of Education
1967

21. Shadows and Sunlight
A Report on Comprehensive Mental Retardation Planning in the U.S. Virgin Islands.
Dept. of Health
1967

22. Hubbard Report (Not exact title)
Analysis and Recommendations of all Governmental Agencies
V.I. Government
1968

23. Bramson, Leon
Report on the Research Conference on the U.S. Virgin Islands Education
Conference intended to point the direction toward an orientation which tries to anticipate the educational needs of the people of the V.I. A decade or two in advance.
Swarthmore College, Penn.
1968

Background Paper No. 4

24. Gabriel, Rehenia A.,
An Operations and Procedures Manual for the Development of Elementary School Guidance in the U.S. Virgin Islands
N.Y.U.
1968

25. Hoggett, Stanley, G. (Project Director)
Echoes of Hope
Final report on a comprehensive statewide planning for Vocational Rehabilitation Services in the U.S. Virgin Islands.
Vocational Education
1969

26. College of the Virgin Islands
A Plan for Higher Education on St. Croix, V.I.
A study of the need and potential for higher education facilities on the island of St. Croix.
C.V.I.
1969

27. Thompson, D.W. and Associates
"An Evaluation of the Demand for Persons with College Level Training in the U.S. Virgin Islands
Report prepared at the request of Dr. R. Orin Cornett, Vice President for Long-Range Planning to assist him in a plan for future development of the College of the V.I.
1969.

28. Bramson, Leon
An Ethnic Census of St. Croix Schools
Swarthmore College, Penn.
1969

29. Blackwood, Paul
Management Review Report on Department of Education
Dept. of Education
1970

30. Social Research Center Staff of U.P.R. & Dept. of Education, V.I.
The Educational setting in the Virgin Islands with Particular Reference to the Education of Spanish-speaking children
U.P.R. & Dept. of Education, V.I.
1970

Background Paper No. 4

31. Callwood, Annie
Learning About the Virgin Islands
Dept. of Education, V.I.
1971

32. Executive Council of the Department of Education in the Virgin Islands
A Model for Establishing a Division of Planning & Evaluation
Dept. of Education
1971

33. Division of Planning Research & Evaluation
Final Report - Mid-Atlantic Interstate Project
Proposed accountability model in education.
Dept. of Education
1972

34. Godreau, G. J. & Associates
Proposed Feasibility Study and Master Plan for Virgin Islands Area Occupational Center
Dept. of Education
1972

35. U.S. Dept. of Agriculture, Food and Nutrition Services
Report on Task Force Study on Virgin Island School Food Service Program
Dept. of Education
1972

36. Title III
Needs Assessment of Education in V.I.
Dept. of Education
1968
1973 (unpublished)

37. Davis, Clark J.
Final Report on Development of a Planning and Evaluation Division within the Department of Education in the V.I.
Dept. of Education
1973

38. Kean, Gwendolyn
Teacher Turnover in the U.S. Virgin Islands 1968-1971
N.Y.U.
1973 - Unpublished

Background Paper No. 4

39. Boulware, Winthrop J.,
Relationship Between Teachers Perceptions of Leadership Behavior & Principals' Self-Concept & Interpersonnel Values in the Public School System
N.Y.U.
1973 - Unpublished

40. Santana, Jose R. & Padin, Jose L.
Blindness & Vision Problems in the School Population in Puerto Rico and the Virgin Islands
U.P.R.
1973

Misc.

Project Introspection has a number of published materials that involved extensive research. Some of the titles are the following:

1. Outstanding Profiles of the V.I.
2. Field Trip Guide
3. European & African Influence in the Culture of V.I.

There are numerous guides that have been published by the Department of Education for the purpose of assisting personnel of the Department of Education.

II. WHAT RESEARCH NEEDS TO BE DONE IN EDUCATION IN THE U.S. VIRGIN ISLANDS?

This question should be answered by stating, "Too many to be listed in this report." Hopefully this question will be discussed and analyzed during the discussion period of the conference, to be enlightened by the diversified

background of the people attending.

The immediate needs will be considered in this section and not the long range (ten or more years) from this present point in time. The long range needs will emerge through the discussion session along with the short range needs.

The immediate needs as the Division of P.R.E. views, are as follows.

(These views are limited in scope and have to be expanded on).

1. What are the responsibilities of the following in educating the pupils?

    1. School responsibilities?
    2. Home responsibilities?
    3. Community responsibilities?

    What are each responsible for and what are they jointly reponsible for?

2. Territorial relationship with the Federal Government in terms of allocations of funds. What monies are the territories getting in relationship to their needs that are the same as state needs.

3. A need to implement alternative means to the

instructional process and to evaluate these processes to determine the most effective for the Virgin Islands pupils, for example:

1. Open classroom concept
2. Ungraded classes
3. Individualized instruction
4. Year-round school

Evaluation is a must to determine the success factor of any of the above mentioned concepts.

4. What effect does Pre-Kindergarten have in comparison to overall social behavior or achievement in relation to pupils without this opportunity and just entering first grade.

5. What is the future (4-5 yrs.) outlook as to the type of local employment that the schools, college should be placing priorities in establishing training and learning experiences for the pupils.

6. Survey of educational policies and procedures implemented by other Caribbean schools - for the purpose of familiarizing Virgin Islands educational personnel with the educational experiences of children from other islands.

7. What are the priorities of the Government?

a - Overall

b - Departmental

A system needs to be developed that may be examined and feedback given on what activities are being implemented to accomplish the intended priority - a budget allocation should reflect established priorities.

These are only seven areas of many possible questions that need to be answered - and that would provide the educational system of the Virgin Islands with valuable information that could be utilized in improving our educational system.

III. WHAT RESOURCES ARE AVAILABLE TO ACCOMPLISH THE NEEDED RESEARCH?

In the midst of the Virgin Islands population - there is enough talent available at present - if pooled to do any research study needed with a very minimum of outside consultant help needed.

I sincerely feel if given the proper procedures and organization of bringing the resources of personnel available, whatever needs to be done can be done by people already living in these islands.

If for some reason there is a need to seek outside consultant help, a procedure must be developed for the firm

or person to train a person or a nucleus of people from these islands to conduct the activity that consultants provided - this should be included in any consultant contract.

Whatever the priority of research need established by the Government - local resources should be considered first before going outside and seeking consultant help.