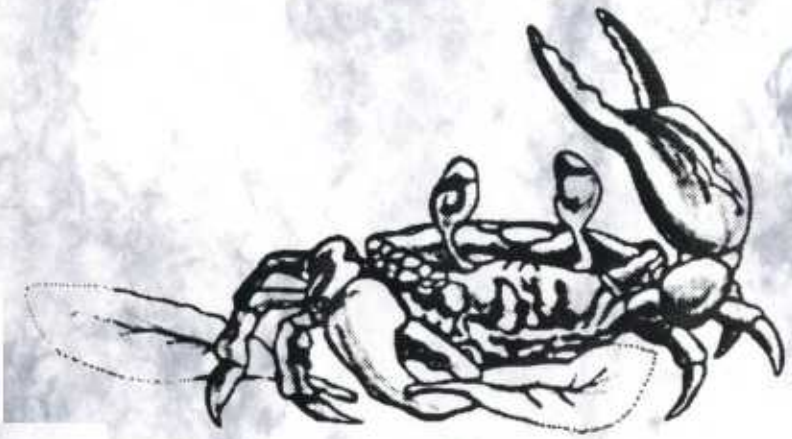
# THE SUSTAINABLE DEVELOPMENT PROJECT AT THE CARIBBEAN ENTRANCE OF THE PANAMA CANAL

Gloria Batista de Vega

PANAMA



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# THE SUSTAINABLE DEVELOPMENT PROJECT AT THE CARIBBEAN ENTRANCE OF THE PANAMA CANAL

**By Gloria Batista de Vega**

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## INTRODUCTION

The University of Panama has created The Panama Canal and International Studies Institute, with the aim of implementing a modern, and permanent system of scientific interdisciplinary research.

The Environmental Department of the Panama Canal Institute has a especial project located in the northeast of the Panama Canal on the Caribbean Sea, "THE SUSTAINABLE DEVELOPMENT PROJECT AT THE CARIBBEAN ENTRANCE OF THE PANAMA CANAL Republic of Panama". It has similar goals for sustainable development.

This project has a great priority for the Country of Panama for two reasons: first, due to the proximity of the area to the Panama Canal. Second, because the second largest city in Panama, Colon, is located on the Caribbean side claimed for a sustainable development alternative. The city and surrounding areas has a population of more than 200,000 inhabitants and an unemployment rate of 32%. Many of these people depend on fisheries offshore for livelihood.

There is a great demand for urban and commercial development of the region due to the proximity of the Panama Canal and high rates of unemployment. In the near by city of Colon unmanaged commercial development will destroy the natural barrier that mangroves and coral reefs create against the sea's encroachment upon the land.

As can be observed, between 1920-1986 the sea level has raised in the area 10 cm Cristobal Port located in Colon city (Panama Canal Commission report, 1986). A management plan for this region needs to be established before any development activities are allowed and located.

The role in this ongoing project became more focused in November 1990 when two things happened. First, the research project: "Participatory Mariculture of Algae in Bahia Las Minas Region, Panama: a Feasibility Study," University of California, Berkeley Master thesis, by Gloria Batista, won the National Wildlife Federation's 1990 Environmental Conservation Fellowship. In 1992, the project received an award from Texaco Foundation in New York.

Second, the Smithsonian Tropical Research Institute through Dr. Norman Duke the chief of the mangrove study in Bahia Las Minas agreed to fund aerial photography of the region and share the images with both the project and the mangrove study in the area. The study correlated these 1:12,000 scale photos with 1:1,000,000 scale satellite (NASA LANDSAT) images to classify the mangrove forest, coral reef, rain forest, urban and industrial area.

Studies by Isabella Abbot and J. Norris, 1985; Mark Hay and J. Norris, 1984, about the Caribbean region identified optimal sites for algae mariculture based on substrate, and proximity to mangrove and coral reef habitats. Also Gloria Batista de Vega studies, 1995, 1996, in progress, identified appropriate activities for development (e.g. agroforestry, industry, housing, ecotourism, and mariculture). The project is working on plans for environmental education, ecotourism development and organized meetings between The United States of America. and Panamanian educators.

In September, 1993, the Management Plan proposed Law to nominate the study area as a "Natural Park of Bahia Las Minas". The Municipality of Colon allocated an office in the Engineering Department (see Budget), that facilitates the development of the Management Plan as we are in contact with the community.

Many support donations from a variety of individuals and institutions, listed in the "Project Budget" (enclosed), have helped the project. We are seeking additional support needed to complete the management plan project.

## GOAL

The purpose of this project is to implement the Sustainable Development Project for the vast and unique riches of the estuaries, mangroves and coral reefs located at the Caribbean entrance of the Panama Canal. The area has approximately 3000 hectares between Isla Margarita (a 61 hectare peninsula) and Bahia Las Minas on the Caribbean coast of Panama. This region has the most extensive system of mangrove forest, coral reefs, and sandy beaches on the central Caribbean coast of Panama.

These ecologically sensitive coastal areas within the Panama Canal are scheduled to come under Panamanian management by the year 2,000, through provisions of the 1977 Carter-Torrijos Treaty. This coastal area includes relatively pristine natural habitats typical of the Caribbean coastal zone (Map).

## OBJECTIVES

The Sustainable Development Project has four objectives: (1) conservation of a unique coastal reef and mangrove forest ecosystem that is protecting Colon City and surrounding communities of the frequent floods in wet season (Batista, 1993). The mangrove and coral reef also serve both as a natural break water and wildlife refuge (Cubit et al, 1986). (2) provision of a research site for a Panamanian and international scientists, (3) environmental education international center for studies and Eco-tourists from Panama and around the world, and (4) improved economic opportunities for local communities through controlled multiple use of the area for fishing and mariculture of algae.

The project is directed by the Department of environment of the Panama Canal Institute of the University of Panama and implemented by the Municipality of Colon with the collaboration of the Authority of the Inter oceanic Region (ARI), the Smithsonian Tropical Research Institute (STRI), which has a marine laboratory in the middle of the area, The Refinery of Panama, located at the end of the study area, the University of California at Berkeley and the Friendship Foundation a non profit organization.

The conservation of mangroves and coral reefs in Panama will contribute to the preservation of global biological diversity, and will ensure the economic productivity of the area for local commercial fisheries.

## PROJECT ACTIVITIES

The project strategy includes five activities over a three year period. A time table is enclosed. The development of these activities will provide opportunities for employment of local residents and at the same time show the world that natural resources in mangrove forest and coral reef areas in the tropics can be used on sustainable basis.

### 1. Land use map.

A. An ecological inventory includes collection of relevant existing data bases from the Panama Canal Commission, the Smithsonian Tropical Research Institute (STRI), the University of Panama, INRENARE and other agencies. The coordination of such data will be a function of the Department of Geographic Data of the Panama Canal Institute. There is a preliminary Management plan of the area with a classification of the area by Satellite LANDSAT and aerial photograph (Batista, 1992).

B. A survey of the physical features of the coast between the City of Colon and Bahia de Las Minas will include geological and geomorphologic data from soils, coral reefs, and beaches. Geographic Information System data will provide maps.

C. More intensive field work needs to be done in order to complete the inventory of the biological features already done by Smithsonian Tropical Research Institute, the University of Panama, and other Institutions. This will be accomplished by concentrating on indicator species for conservation, identifying and assessing the status of rare, endangered, and threatened species, and studying ways of preserving the existing biological diversity.

### 2. Mangrove and coral reef study

A. The integrated mangrove and coral reef study involves the 1,690 hectares of mangrove forests. Already 5 years of mangrove studies have been completed in the area by Dr. Norman Duke et al., 1992, 1993, Dr. Howard Tea, 1988 and Dr. Wayne Sousa mangrove forest studies in progress, plus many other studies of coral reefs by Peter Glyn et al., and future programs with the collaboration of the U.C. Berkeley. The assignment of graduate National and International students, advanced degree work with long-term commitments to projects will be designated by an interdisciplinary committee.

### 3. Human utilization of the area

A. A vital part of the study is the assessment of the human utilization of the area, such as use by fishermen, gathering of fuelwood, seaweed's farms and coral reef aquaculture. This would involve incorporating the needs of the Panamanians who now depend on the natural resources of these areas. Mrs. Gloria Batista de Vega the Panama Canal Institute of the University of Panama, will lead this part of the study. The assignment of volunteers, professional level people with long-term commitments to implementation stages could be designated by an interdisciplinary committee.

**4. Financial viability**

A. The financial viability of the Sustainable Project is an important aspect of the plan. Initially, financial support of activities within the reserve will depend on external subsidies. Estimates will be developed for both the costs of managing the reserve and the potential levels of income from reserve activities such as tourism, ecotourism, and other specific external subsidies such as government and private funds. The Environment and Geographic Data Department of the Panama Canal Institute and the Municipality of Colon will lead this part of the study in cooperation with Panamanian and International Managers of similar projects and areas.

B. The value, in dollars per year, of a hectare of mangroves and kilometer of coral shoreline is difficult to calculate. However this has been accomplished in other areas of the world. Therefore, valuations can be used in this case to improve economic alternatives for the Country of Panama.

**5. Development of a tourism plan for the area**

A. A tourism plan for the area will include several activities. Among other things it would be necessary to identify specific boat rides, hiking paths and roads that can be used by local tourism companies. It will also be necessary to determine the cost of initialing a board walk through the mangroves, and clean the road behind the firing range on the road to be used by cars or pedestrians. Rest areas should be installed where visitors can eat snacks and rest. A mangrove forest and coral reefs interpretation paths, being studied by Gloria Batista de Vega.

B. Policies for leasing concessions to local tourist companies to take tourists into the Park should be developed. For the privilege of using the park, tourist companies should agree to build and maintain a dock, a board walk, and manage rest areas. Tourist companies also would hire and manage a boat operation and guides.

**6. Economic Opportunities**

One of the goals of this management plan is to improve economic opportunities for local communities through controlled multiple uses in the study area such as seaweed mariculture. Seafarms is well-suited for project goals.

Gloria Batista's studies in 1992, determined through interviews that local fishermen are interested in raising their families' incomes through seaweed farm activities. In these interviews we also considered why local fishermen harvested wild alga populations and how they view their involvement in seaweed farms.

The experimental design by selecting the sample, shows minimum differences for biological significance and established some management and farming practices for Gracilaria spp.

Cultivation of Gracilaria sp (seamoss) has the potential of contributing significantly towards the socio-economic development of rural coastal communities on the Caribbean coast of Panama and consequently will prevent the over-exploitation of the existing habitats along the shoreline.

The present approach can serve as a model for the management of similar coastal areas. For example, the management plan area has platforms of fringing reefs forming broad shallow habitats along the Caribbean coast of Panama. These reef platforms often enclose lagoons and channels and are backed on the landward side by mangroves and by sand beaches in many areas of the Caribbean. These structures are covered with highly productive stands of algae and seagrass and are common features of mature reefs throughout the tropics.

Considerably more information needs to be collected and more researches mariculture and other opportunities for the local and international communities need to be improved based on the need of the Country of Panama and the international commerce before the plan for the reserve is developed.

| *PROJECT ACTIVITIES* | *TIME* |
|---|---|
| **INVENTORY AND COORDINATION** | **0-6 months** |
| Assembly of existing information: | |
| Maps | |
| Air Photos | |
| Satellite Image | |
| Climatic data | |
| Coordination of the program | |
| Inventories: | |
| Fauna | |
| Flora | |
| Zone classification | |
| **PHYSICAL INVENTORY** | **6-12 months** |
| Topography | |
| Geology | |
| Soils | |
| Landscapes | |
| INTEGRATED MANGROVES AND CORAL REEFS STUDIES | |
| **ECONOMIC OPPORTUNITIES** | |
| Alternatives: | |
| Free Port | |
| Commercial Free Zone | |
| Colon City | |
| Fisheries | |
| New employment implementation Programs | |
| Trainer Programs | |
| Improve Economics condition in the area. | |
| Coustoum and needs of the ethnic groups and Integration Programs. | |

| *PROJECT ACTIVITIES* | *TIME* |
|---|---|
| **INVENTORY AND COORDINATION** | **0-6 months** |

Assembly of existing information:

Maps
Air Photos
Satellite Image
Climatic data
Coordination of the program

Inventories:

Fauna
Flora
Zone classification

| | |
|---|---|
| **PHYSICAL INVENTORY** | **6-12 months** |

Topography
Geology
Soils
Landscapes

INTEGRATED MANGROVES
AND CORAL REEFS STUDIES

**ECONOMIC OPPORTUNITIES**

Alternatives:
Free Port
Commercial Free Zone
Colon City
Fisheries
New employment implementation Programs

Trainer Programs
Improve Economics condition in the area.
Coustoum and needs of the ethnic groups and Integration Programs.

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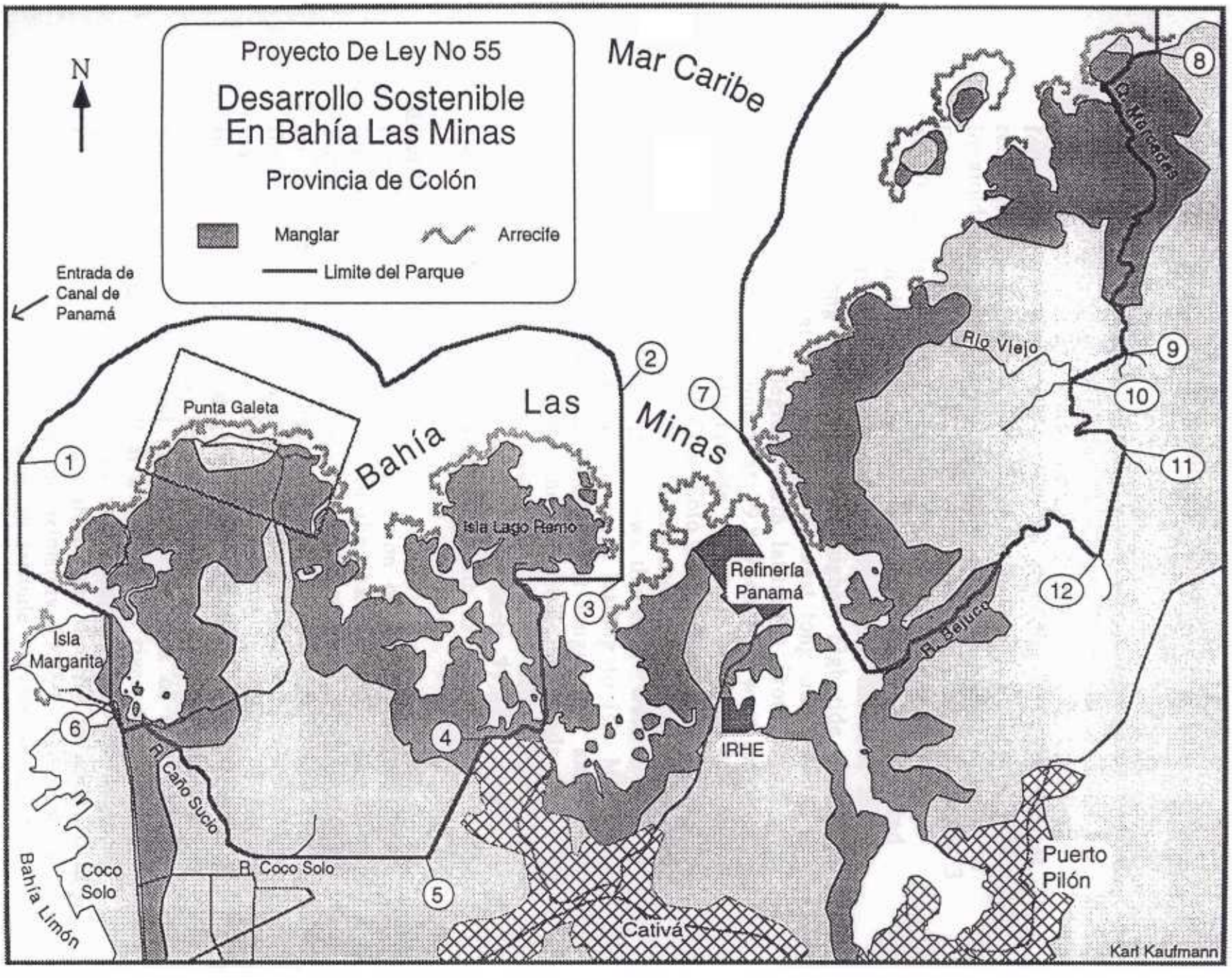
# THE SUSTAINABLE DEVELOPMENT PROJECT AT THE CARIBBEAN ENTRANCE OF THE PANAMA CANAL

RESEARCHE ACTIVITIES

PROJECT N° 01-00-00-15-95-01

January 1996 to December de 1997

| ACTIVITIES | J | F | M | A | M | J | J | A | S | O | N | D |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Research paths | 96 | 96 | 96 | 96 | | | | | | | | |
| Work Shop | | | | | 96 | 96 | 96 | | | | | |
| Field Work Tests | | | | | | | | 96 | 96 | 96 | | |
| Video | | | | | | | | | | | 96 | |
| Publications and presentations | | | | | | | | | | | 96 | 96 |
| Farming feasibility of *Gracilaria* sp | | | | | | | | | | | | |
| Planting | | | | | | | | | | 97 | | |
| 1st Harvest | 97 | | | | | | | | | | | |
| 2th Harvest | | | 97 | | | | | | | | | |
| Results | | | | 97 | 97 | | | | | | | |
| Publications | | | | | | 97 | 97 | | | | | |
| Presentation | | | | | | | | | 97 | 97 | 97 | 97 |


Proyecto De Ley No 55
Desarrollo Sostenible
En Bahía Las Minas
Provincia de Colón
Manglar
Arrecife
Limite del Parque
N
Entrada de
Canal de
Panamá
Mar Caribe
Punta Galeta
Bahía
Las
Minas
Isla Lago Piemo
Refinería
Panamá
IRHE
Río Viejo
R. Belluco
Q. Mariadas
Isla
Margarita
R. Caño Sucio
R. Coco Solo
Coco
Solo
Bahía Limón
Cativá
Puerto
Pilón
1
2
3
4
5
6
7
8
9
10
11
12
Karl Kaufmann

## Boundaries of the Park at Bahía las Minas

### Western Part

Point 1 is at 79.888 degrees west longitude (and approximately 9.375 degrees north latidude) at a point 1 kilometer from the closest reef crest to the southeast. From there the boundary follows a line to the east exactly 1 kilometer from the nearest reef crest to the south until it intersects 79.824 degrees west longitude (and approximately 9.397 degrees north latitude) at point 2. From there, the boundary goes due south to point 3 at 79.824 degrees west longitude and 9.334 degrees north latitude. Then it goes due west until it intersects a road, and follows the road south. The boundary leaves the road and heads west ålong the line of mean highest high tide until it reaches point 4 at 79.845 degrees west longitude ( and approximately 9.293 degrees north latitude ) From here, it goes southwest to point 5 at 79.849 degrees west longitude and 9.293 degrees north latitude. Then it proceeds east to the intersection with the Rio Coco Solo and follows it to the confluence with the Rio Caño Sucio and from there to the road leading to Punta Galeta. It follows this road west to another road, and then north along the road leading to Isla Margarita. Where this road intersects 79.881 west longitude ( and approximately 9.304 degrees north latitude) it heads due north to the intersection with the shoreline. From this intersection, it heads northwest by west until it intersects 79.888 degrees west longitude, and then goes due north to point 1.

### Eastern Part

Starting at point 7 at the intersection of 79.820 degrees west longitude and the north edge of the channel leading out of Bahía las Minas (approximately 9.304 degrees north lattitude), the boundary proceeds due north to a point 1 kilometer from the nearest reef crest and then follows a line to the north west that isl kilometer from the reef crests to the south. When this line intersects 79.781 degrees west longitude, it heads due south until it intersects the shore at point 8. From there it follows the shoreline and then the west bank of the Quebrada Mercedes south to point 9 at a fork in the river at approximately 79.785 degrees west longitude, 9.400 degrees north latitude. The boundary then goes directly to point 10 at a fork in the Rio Viejo at approximately 79.789 degrees west longitude and 9.393 degrees north latitude. From there, it

follows the west bank of the river to point 11 at a fork at approximately 79.785 degrees west longitude and 9.375 degrees north latitude. Then it goes directly to point 12 at a sharp bend in the Rio Bejuco at approximately 79.787 degrees west longitude and 9.345 degrees north latitude. The boundary then follows the south bank of the Rio Bejuco to its mouth and then goes north along the west edge of the channel leading past Refinería Panamá to point 7.

KWK 3/7/94

Area of park at Bahía las Minas

| | | | |
|---|---|---|---|
| Western part | | | |
| Total 25.03 sq km | | | |
| Mangrove | | | |
| Margarita Lagoon | .02 sq km | | |
| Palma Media | .27 | | |
| Western Bay | .04 | | |
| | | .25 | |
| | | .09 | |
| | | .04 | |
| Lago Remo Bay | | .02 | |
| | | .02 | |
| Lago Remo | | 1.60 | |
| Mainland | | 5.64 | |
| | | | 7.99 sq km |
| Upland | | | |
| Navy Base | | .24 | |
| Other | | 5.00 | |
| | | | 5.24 |
| Water | | 11.8 | |

| | | | |
|---|---|---|---|
| Eastern Part | | | |
| Total 22.54 sq km | | | |
| Mangrove | | | |
| Naranjos 1 | .07 sq km | | |
| Naranjos 2 | .07 | | |
| Island | .10 | | |
| North mainland | 1.8 | | |
| South Mainland | 2.02 | | |
| Island | .14 | | |
| | | | 4.20 |
| Upland | | | |
| Naranjos 1 | .08 | | |
| Naranjos 2 | .10 | | |
| Island | .03 | | |
| Mainland | 7.14 | | |
| | | | 7.35 |
| Water | | | 10.99 |

Note : 100 hectares = 1 sq km.

Area of entire park at Bahía las Minas

| | | |
|---|---|---|
| Mangrove | | 1219 hectares |
| Upland | | 1259 hectares |
| | sub total | 2478 hectares |
| Water | | 2279 hectares |
| | total | 4757 hectares |

kwk 3/7/94

THREE YEAR BUDGET FOR A SUSTAINABLE DEVELOPMENT PROJECT

AT THE CARIBBEAN ENTRANCE OF THE PANAMA CANAL

## 1997 to 1999

| COMPUTER PRODUCTS | First Year | Second Year | Third Year |
|---|---|---|---|
| Geographic Information Systems | | | |
| Acer Altos Pentium 133 MH2/16 MB Ram | $2,300.00 | $2,500.00 | $2,600.00 |
| Microsoft Windows 95 | | | |
| ARC View Windows (3.5 en adelante) | | | |
| Software PC-ARC/INFO 3.4D | $2,625.00 | $2,887.50 | |
| Image Process System | | | |
| Dragon 4 IS | $1,500.00 | $1,650.00 | |
| Desk Jet HP 550C | $714.00 | $785.40 | |
| Microsoft Office | $3,998.00 | $4,100.00 | |
| Digitize Table | $8,000.00 | $8,800.00 | |
| Full Page Color Scanner | | | |
| Computer Maintenance | $1,000.00 | $1,100.00 | $1,210.00 |
| **Sub Total** | **$20,137.00** | **$21,822.90** | **$3,810.00** |
| | | | |
| **PHOTOS** | | | |
| New Aerial photography | | | |
| Acquisition | $5,000.00 | $5,500.00 | $5,600.00 |
| Purchase of existing | | | |
| Photography and Maps | $1,500.00 | $1,500.00 | $1,600.00 |
| Lands Thematic Mapped Imagery | | | |
| With Tapes | $5,500.00 | $6,050.00 | $6,150.00 |
| With slides | $1,000.00 | $1,100.00 | $1,200.00 |
| **Sub Total** | **$13,000.00** | **$14,150.00** | **$14,550.00** |
| | | | |
| **SUPPLIES** | | | |
| Computer Supplies | $500.00 | $1,000.00 | $2,000.00 |
| Other equipment and Supplies | $3,000.00 | $4,000.00 | $4,000.00 |
| **Sub Total** | **$3,500.00** | **$5,000.00** | **$6,000.00** |
| | | | |
| **TRAVEL EXPENSES slide.** | | | |
| Pick up Truck Double Cabin | $22,000.00 | | |
| Car Insurance | $784.00 | $627.00 | $1,000.00 |
| Diesel | $8,000.00 | $2,600.00 | $3,500.00 |
| Car Maintenance | $200.00 | $400.00 | $800.00 |
| Boat With Outboard | $1,738.00 | $1,500.00 | $2,000.00 |
| Gas 6 Gallons/3 hours | $2,000.00 | $2,000.00 | $3,000.00 |
| Boat Maintenance | $80.00 | $80.00 | $160.00 |
| **Sub Total** | **$34,802.00** | **$7,207.00** | **$10,460.00** |

| | | | |
|---|---|---|---|
| **INTERNATIONAL TRAVELS** | | | |
| Air Fares (Panama-St. Fco.) | | | |
| 4 Research Associates | $4,800.00 | $4,800.00 | $5,000.00 |
| Per Diem, 40 days 0 $80.00/day | $3,200.00 | $3,200.00 | $4,000.00 |
| **Sub Total** | **$8,000.00** | **$8,000.00** | **$9,000.00** |
| **Total Three year Budget Need** | **$79,439.00** | **$56,179.90** | **$43,820.00** |

## PANAMA GOVERNMENT CONTRIBUTION IN SPACE

## MUNICIPALITY OF COLON, THE PANAMA CANAL INSTITUTE OF THE UNIVERSITY OF PANAMA

| **OFFICE EXPENSES** | **First Year** | **Second Year** | **Third Year** |
|---|---|---|---|
| Office Space at the Engineering Department of the Municipality of Colon $3.50/sq m x 500 sq. | $1,750.00 | $1,750.00 | $1,750.00 |
| Assigned Secretary $550.00/month | $6,600.00 | $6,600.00 | $6,600.00 |
| Office Equipment Rent | $1,000.00 | $1,000.00 | $1,000.00 |
| Office Supply | $3,700.00 | $3,700.00 | $3,700.00 |
| **Sub Total** | **$13,050.00** | **$13,050.00** | **$13,050.00** |

## PANAMA CANAL INSTITUTE TECHNICAL CONTRIBUTION

| | | | |
|---|---|---|---|
| **COMPUTER TIME** | | | |
| Computer time for satellite data processing. 100 hour, 20.00/hour | $2,000.00 | $2,500.00 | $3,000.00 |
| Computer time for building GIS 150 hours, 20.00/hour | $3,000.00 | $3,500.00 | $3,500.00 |
| **Sub Total** | **$5,000.00** | **$6,000.00** | **$6,500.00** |

## CITY HALL OF COLON, GOVERNMENT CONTRIBUTION

| | | | |
|---|---|---|---|
| Lic. María del C. Barrios | $16,000.00 | $16,000.00 | $16,000.00 |
| Dr. Miguel Angel Cañizales | $16,000.00 | $16,000.00 | $16,000.00 |
| Lic. Marco Santa María | $16,000.00 | $16,000.00 | $16,000.00 |
| Arq. Daniel Chen | $16,000.00 | $16,000.00 | $16,000.00 |
| **Sub Total** | **$64,000.00** | **$64,000.00** | **$64,000.00** |

## UNIVERSITY OF PANAMA

| | | | |
|---|---|---|---|
| $160.00 /day x 100 days/year | | | |
| Dr. Víctor Vega (International Lawyer) | $16,000.00 | $16,000.00 | $16,000.00 |
| Dr. José Barrios (Economist) | $16,000.00 | $16,000.00 | $16,000.00 |
| Lic. Damián Rodríguez (Geographer) | $16,000.00 | $16,000.00 | $16,000.00 |
| Mr. Mario Plneda ( Analyst GIS) | $16,000.00 | $16,000.00 | $16,000.00 |
| Ms. Gloria Batista (Coastal Management) | $16,000.00 | $16,000.00 | $16,000.00 |
| **Sub Total** | **$80,000.00** | **$80,000.00** | **$80,000.00** |
| **Total Government Contribution** | **$162,050.00** | **$163,050.00** | **$163,550.00** |

INTERNATIONAL CONTRIBUTIONS IN SPECIE UNIVERSITY OF

CAROLINA AND INSTITUTIONS IN BERKELEY
(INTER. TECHNICAL ASSISTANCE CONTRIBUTIONS)

| | First Year | Second Year | Third Year |
|---|---|---|---|
| $250.00/day x 40 days/year<br>Dr. Arnold Schults<br>PH. D Ecosystem | $10,000.00 | $10,000.00 | $10,000.00 |
| Dr. Ronald L. Ritschartd<br>PH. D. Photogrametry | $10,000.00 | $10,000.00 | $10,000.00 |
| Mr. John Garcia<br>Management of Coast Zone | $10,000.00 | $10,000.00 | $10,000.00 |
| Dr. David Staddort<br>PH. Ecology of Coral Reef | $10,000.00 | $10,000.00 | $10,000.00 |
| Dr. Jeff Bryant<br>Environment Education's Specialist | $10,000.00 | $10,000.00 | $10,000.00 |
| **Sub Total** | **$50,000.00** | **$50,000.00** | **$50,000.00** |
| **TOTAL INTER TEACH CONTR.** | **$291,489.00** | **$269,229.90** | **$207,370.00** |