

## Proceeding of the Coastal & Terrestrial Workshop on the Identification of Research Priorities for Port Honduras Marine Reserve, TIDE Lands, Golden Stream Corridor Preserve and Surrounding Lands



Punta Gorda Town, Toledo District, southern Belize  
September 25<sup>th</sup>, 2005 - September 27<sup>th</sup>, 2005

### ***Overview***

A workshop was held in Punta Gorda Town to identify how best to focus a field research program to support local management efforts for the Port Honduras Marine Reserve (PHMR), TIDE Lands, Golden Stream Corridor Preserve (GSCP) and surrounding lands. These proceedings present the research priorities as discussed by stakeholders and scientists. Based on these priorities, Earthwatch will collaborate with scientists to develop a multi-species comprehensive field research project to investigate management issues and factors influencing these regions. A dissemination network was discussed, and collaborations between local, national, and international scientists and educators were discussed as a way to build local capacity for community members, stakeholders, and local agencies.

The results of the workshop also provided Earthwatch Institute with a basis to develop its strategic plan for the Belize Conservation Research Initiative (CRI) through research, education and public engagement.

### ***Background***

Situated in the Toledo District of Belize, the Earthwatch's Conservation Research Initiative (CRI) runs east from the ridge tops of the Maya Mountains through rainforests, coastal plains, and mangrove forests to the world's second largest barrier reef, a UNESCO World Heritage Site. This unique slice of tropical habitat is home to whale sharks, manatees, jaguars, crocodiles and over 540 species of birds. The region is populated by a great diversity of people and cultures, including Garifuna, Maya, East Indian and Creole, and is steeped in the rich history of the Maya civilization.

Although considered one of the most well preserved regions of Belize, the Sapodilla Cayes and the nearby coast and rainforest are vulnerable to a variety of factors that negatively affect their ecological health and the diversity of life that depends on them. Threats to the area include land-based runoff from agriculture, sewage and pollution from shipping and industry, unplanned development, and expanding recreational activities, as well as over-fishing.

Earthwatch is collaborating with local partners and community members to prioritize conservation and research needs in the southern Belize.

In May 2005, a first workshop was held in Punta Gorda, Belize, in which thirty-five individuals representing 19 organizations participated. During this workshop, the community, stakeholders, and local organizations associated with the Sapodilla Cayes Marine Reserve expressed the priority need to study the sustainability of the fisheries of the SCMR. In response, local and international scientists have created a multi-species, comprehensive field research project to begin to determine the state of the fisheries and ecosystem, and the factors that influence it. The ultimate goal is for the research to enable local organizations to manage the Sapodilla Cayes Marine Reserve natural resource more effectively. The proceedings are available online at <http://www.earthwatch.org/conservation/>.

### ***Objectives of the Coastal and Terrestrial Workshop***

This second workshop focused on coastal and terrestrial conservation research priorities, which will also be supported through Earthwatch field research projects.

The data and results from these projects will contribute to the understanding of the delicate natural balance and human impacts in the area and contribute to sustainable management plans for the ecosystem.

The objectives of the workshops were to work with local community leaders, local and international researchers, conservation workers, and government management representatives to:

- 1. Work with key stakeholders to generate a prioritized list of critical environmental issues and identify those for which research and monitoring data and analysis are critical to addressing issues.*
- 2. Work with researchers and stakeholders to identify existing and/or needed research and monitoring projects that address the priority list of environmental issues and that would contribute toward a management plan, policy or intervention.*
- 3. Work with Earthwatch scientists and others to generate research projects that will start in 2007 and that fit the needs assessment done above.*

### ***Summary***

On Sunday, September 25, participants visited the Port Honduras Marine Reserve (PHMR) and Golden Stream Corridor Preserve (GSCP).

The workshop began on Monday, September 26, at the Francis J. Ring Parish Hall in Punta Gorda Town with an opening prayer from Fr. Dick Perl and an official welcome from the Mayor of Punta Gorda Town, Mayor Carlos Galvez, which was followed with:

- An introduction to the workshop and overview of the Belize Conservation Research Initiative by Karl Castillo (Field Director Belize CRI)
- An introduction to Port Honduras Martine Reserve (PHMR), TIDE Lands, and Paynes Creek National Park (PCNP), and a presentation of TIDE.'s research priorities for these areas [Appendix A -TIDE Research Priorities.doc](#) by Dr. Robin Coleman, TIDE's Stewardship Director. ,
- An introduction to Ya'axché Conservation Trust's (YCT's) program in Toledo and presentation of YCT's research priorities for the Golden Stream Corridor Preserve (GSCP; [Appendix B](#)) by Bartolo Teul, YCT's Project Director.
- An introduction to Sartoon Temash Institute for Indigenous Management (SATIIM's) program in Toledo and a presentation of SATIIM's research priorities for the Sartoon Temash Region ([Appendix C](#)) by Miss Lynette Gomez, Technical Coordinator.
- Jan Merman Biodiversity and Environmental Resource Data Systems (BERDS) gave a presentation on data management systems.

Stakeholders then gave feedback and refined the list of research priorities presented by the NGOs. Participants then broke out into three groups based on freshwater, marine, and terrestrial biomes in order to:

1. Identify where research and monitoring data are critical to addressing the issues.
2. Define the research questions.
3. Define the research priorities for the next two to three years.

A summary of the group presentation results are attached (see [Appendix D](#))

To wrap up the day we had a dynamic presentation from Dr. Philip Morgan, which outlined several environmental issues facing Toledo today.

The second day's presentations included:

- A welcome from Mr. Nicodemus Bol, the Belize CRI Operations Manager.
- A presentation on "Terrestrial Biodiversity System adapted by YCT, TIDE and SATIIM" done by Nick Wicks.
- A presentation on the Earthwatch model for research by Earthwatch's Director of Research, Dr. Daniela Maldini
- An example of the Earthwatch model of scientific research based on an Earthwatch mangrove project Mexico by Jerry Keir, an Earthwatch Principal Investigator.

Participants then broke out into two groups to identify existing projects, programs, partners, and scientists working on the research priorities identified from the previous day. The research questions were then further prioritized and any existing project gaps were identified (see [Appendix E](#))

The workshop ended with three presentations:

- An introduction to the Earthwatch Fellowship program by Rachel Dobson.

- A presentation about the BERDS by Jan Meerman.
- A presentation about the creation of a national biodiversity-monitoring program by Paul Walker

The representatives of the three organizations that co-hosted the workshop, YCT, TIDE and SATIIM, gave a final thank you.

## ***Outcomes***

### I. Research

Based on feedback from stakeholders on the issues facing both coastal and terrestrial reserves presented by TIDE, SATIIM, and YCT, the following biome research priorities were defined:

- Coastal and Marine
- Freshwater
- Terrestrial

Within coastal and marine, freshwater, and terrestrial biomes, stakeholder groups identified areas where research and monitoring data are critical in addressing the issues.

**A. The Coastal and Marine** group identified several biome priorities, formative projects and research gaps:

- Cultural and socio-economic significance of marine and coastal resources
- Water quality
- Fish recruitment
- Coral reefs
- Sea turtles and Manatees
- Mangroves
- Sea Grass
- Sooty Terns

Potential coastal study area ([see Appendix D](#) - for complete list of study areas):

- Expansion of water quality research in coastal marine areas
- Fish recruitment within the Port Honduras Marine Reserve
- Expansion of current monitoring efforts in coastal terrestrial areas

**B. The Freshwater** group focused on:

- Watershed management
- Water quality
- Status and indicators for aquatic biodiversity health
- Hydrology
- Value of water socially and economically
- Transboundary issues in watersheds

Potential freshwater study area ([see Appendix D for complete list of study areas](#)):

- Hydrology of Toledo watersheds – citing existing projects such as that done by Dr. Philip Morgan

Participants recognized that in the long term, many of these research questions would provide results, but that it was important to develop a project that would provide results to the stakeholders in the short-term. The participants identified water quality research as the project most likely to provide immediate results to stakeholders.

C. The **Terrestrial** group focus was extended into several priorities:

- Natural resource management
- Baseline data for (all) major taxonomic groups and species of concern
- Structure and condition of ecosystems
- Establish a baseline for land use and land use change
- Assessing and monitoring threats
- Social and economic uses of resources
- Cultural heritage

Potential terrestrial study areas (see [Appendix D](#) for complete list of study areas):

- The population of hunters and harvesting frequency within the region
- Social research such as demographic changes in the region over time
- The economic aspects of agro forestry, ecotourism, and agriculture.

## II. Management

An important outcome of the workshop was the recognized need for a mechanism to ensure that research is linked to national/ international protocols and action as identified by stakeholders. Stakeholders in biome groups discussed options as of how to carry out appropriate research strategies. The groups unanimously agreed that there is a need for standardized programs, methods and reliable equipments. The need for training of community groups was discussed as a long-term beneficial act.

## III. Information Dissemination

Participants identified the need for information to be disseminated and readily available to local and international communities. Stakeholders expressed the need to publish ongoing and summative reports in relevant media outlets and make them available in several of the following areas: Department of Fisheries, University of Belize's library, National Public library, all regional conservation and science NGOs, communities, government, and be made globally accessible. Methods to reach audiences include personal communications and involvement, internet sites, scientific meetings, scientific publications, radio programs, and local TV. The primary source of storing information and making it available to all audiences was identified as The University of Belize's Library.

#### IV. Capacity Building

Workshop participants expressed a need for enhanced capacity building in relevant communities to foster development and sustainability through training and local involvement in research projects. Suggested methods to achieve this include operational funding assistance, development sessions such as management training, and supporting collaboration with other organizations.

#### V. Workshop evaluation.

The Coastal Terrestrial Research Workshop evaluations indicated that the participants see a need for guidelines for proper dissemination of research information. There was also a strong emphasis on the need for increased development of community outreach programs. The participants were particularly concerned about the materialization of research from the list of research priorities presented. One suggestion was to develop a subsequent workshop to discuss research priorities that have been addressed and plans for the implementations of others outlined in the workshop. The overall rating of the workshop clearly showed that it was ranked as being successful. Please contact the Earthwatch Belize CRI main office for a detailed graphical analysis of the workshop evaluation.

#### VI. Conclusion

The three main objectives of the workshop were achieved. The first objective was to work with key stakeholders to generate a prioritized list of critical environmental issues and identify those for which research and monitoring data and analysis are critical to addressing issues. This objective was directly achieved from the detailed list of research priorities presented by the partners organizations and stakeholders, and are presented in the outcomes as listed in [Appendix D –Belize workshop research priorities.xls](#)

The second objective was to work with researchers and stakeholders to identify existing and/or needed research and monitoring projects that address the priority list of environmental issues and that would contribute toward a management plan, policy, or intervention. This objective was also addressed by the results as presented in [Appendix E](#) by participant groups formed to identify existing researchers and research efforts to minimize the likelihood of duplications of efforts.

The final objective was to work with Earthwatch scientists and others to generate research projects that will start in 2007 and that fit the needs assessment done above. Three coastal projects have already been developed. One project includes expansion of the existing monitoring efforts with TIDE to begin to work on the research priorities they put forth in the workshop.

## VII. Workshop Participants

[Appendix F](#) contains a list of the workshop participants, their organizational affiliation, and contact information.

## VIII. Pictures

Please contact the Earthwatch Belize CRI main office if you would like a CD of pictures from the workshop.

(APPENDIX A)

## TIDE's Research Priorities (September, 2005)

### *Port Honduras Marine Reserve*

#### Water Quality

- Important indicator since it is a key determinant of overall ecosystem health
- Greatest threat is from agricultural runoff of the five major rivers that drain into the Reserve (Monkey River, Golden Stream, Deep River, Middle River and Rio Grande)

#### [Proposed Research Activity](#)

- Water quality monitoring

#### ***Mangrove, Seagrass and Coral Reef Studies***

- About 138 mangrove islands within PHMR; contributes to productivity by providing nutrients
- Sea grass supports high biodiversity; sensitive to changes in water quality, therefore, considered an important indicator species that reflect the overall health of coastal ecosystems
- Coral reefs provide habitat and food, threatened by agricultural runoff

#### [Proposed Research Activities](#)

- How do mangroves influence the community structure of fish on neighboring reefs
- Monitor community composition and biomass of sea grass within the reserve
- Assess coral reef health

#### ***Recruitment Studies***

- PHMR is known to be a recruitment area for many of the commercial fish species.
- Not enough scientific evidence to prove this hypothesis

#### [Proposed Research Activity](#)

- Identify recruitment areas of these valuable commercial species within the reserve

#### ***Commercial Species Stock Assessment***

- PHMR has several important commercial species

#### [Proposed Research Activities](#)

- Stock assessment of key commercial species:

- Conch
- Lobster
- Goliath Grouper
- Lane Snapper

#### ***Sea Turtle and Sooty tern***

- Three sea turtle species are found within PHMR; nesting sites are located between the sandy beaches of the reserve starting from Scotland point all the way to Monkey River Village.
- The Sooty tern is a migratory species that nests only on Middle Snake Caye, the preservation zone

#### [Proposed Research Activities](#)

- Studies on distribution, abundance and movement patterns

## Paynes Creek National Park

### **Fire management**

- Increased frequency of fires in the park as a result of hunters wanting to attract white-tailed deer
- Fires are the primary source of soil erosion and change in soil chemistry
- Proper fire management will benefit savannah specialists such as yellow headed parrot as well as the pine trees, Baird's tapir, jaguar and white tailed deer

### **Proposed Research Activities:**

Map areas that are actively eroding or under threat of soil erosion

Map areas of pine stands where small seedlings have been killed outright by fires

Areas mapped should be reforested and/or also planted with appropriate grass species to help bind the topsoil

Methods to increase the areas with very low soil pH should be identified (dolomite)

### **Hydrology**

- Extensive wetlands and lagoon ecosystems within the park provide nutrients to support biotic communities of the coastal embayment
- Absorb pollutants that are potentially toxic to aquatic organisms
- Serve as a flood control mechanism (catchments area for Monkey River floods)
- Integral link to Port Honduras Marine Reserve

### **Proposed Research Activities:**

- Water quality monitoring
- Precipitation and run off estimation
- Discharge measurements
- Inventory of flora within the park*
- Need to determine abundance and distribution of some plant species within park

### **Proposed Research Activities**

- Inventory

### **Yellow Headed Parrot (*Amazona oratrix*)**

- Listed as endangered by IUCN Red List 2004
- Decline throughout range due to habitat destruction for development, increased man-made fires over the pine savannah areas and the theft of nestlings for the pet trade
- In PCNP, further threatened by the increasing frequency of fires (burning nesting trees) and the harvesting of seedlings

### **Proposed Research Activities**

- Identification and wardening of nesting sites
- Population status studies

### **West Indian Manatee**

- Listed as vulnerable by IUCN Red List 2004
- Considered an umbrella species for the health of sea grass ecosystems

•Also found within the PHMR

### **Proposed Research Activities**

- Population studies
- Monitoring program

## **Private Lands Initiative**

### **Baseline Assessments**

Need to prioritize relative values of areas in order to make informed decisions about where different management activities should be developed within these areas

### **Proposed Research Activities:**

Biological Surveys of mammals, birds and trees within the area to identify the most important areas/species for conservation action

### ***Hicatee Turtle (*Dermatemys mawii*)***

- Listed as endangered by IUCN Red List since 1983
- Decline throughout range due to hunting pressure
- Rio Grande is a habitat for the turtle, but also loosing its turtles due to over harvesting

#### **Proposed Research Activities:**

- Population status studies
- Hicatee Rearing Program

### ***Mahogany (*Swietenia macrophylla*)***

- Listed as vulnerable by IUCN Red List 2004

#### **Proposed Research Activities:**

- Collection of biological data on saplings within reforestation sites

### ***Assessment of freshwater discharge into the Gulf of Honduras***

- 5 major rivers (Monkey River, Golden Stream, Deep River, Middle River and Rio Grande) that deliver freshwater, sediments and nutrients to the coastal zone; also deliver pollutants and solid waste materials

#### **Proposed Research Activities:**

- Collect river discharge data at 5 major rivers
- Determine nutrient and sediment load which affects productivity, as well as volume of water being discharged into PHMR.

### ***Impact assessment on Monkey River and its tributaries***

- In 2001, TIDE conducted an impact assessment of 4 major rivers.
- Need to conduct impact assessment as least once every two years
- Impact assessment will be done on major watersheds that have an impact on the Gulf of Honduras (YCT and SATIIM?)

#### **Proposed Research Activities:**

- Conduct impact assessment on Monkey River using GPS and Kayaks.

### ***Developing alternative means of generating income for communities***

- Tide's Mission is to lead the development of responsible tourism and other environmentally sustainable economic alternatives by providing training and support to local residents.

#### **Proposed Question:**

What other alternative means exist for generating income for communities

(Appendix B)

## YCT Research Priorities

### 1) Broadleaf lowland and hill forest

Structure

Composition

Functioning

Coverage & Connectivity

**Justification:** 1) nurtures a huge variety of life forms and many endangered species, 2) safeguards watersheds, 3) Sequesters Carbon. **Current research:** Vegetation monitoring, mammal & cracid monitoring system.

### 2) Riverine and riparian ecosystems

**Justification:** Rivers of Toledo flow into PHMR and MBR, highly threatened by intensive agriculture / aquaculture, logging, fires, subsistence farming and village waste. **Upcoming research:** Freshwater health and threat monitoring system & research programme

### 3) Mammalian Game species

**Justification:** threatened by hunting includes endangered howler monkeys (*Alouatta pigra*), and data deficient red brocket deer (*Mazama americana*) & northern naked tailed armadillo (*Cabassous centralis*). Also includes good ecological indicators such as white lipped peccary (*Tayassu pecari*).

**Current research:** Vertebrate monitoring system

4) Tapirs (*Tapirus bairdii*) **Justification:** national mammal, although common in Toledo, Tapirs are endangered.

**Current research:** Vertebrate monitoring system

### 5) Large mammalian carnivores

**Justification:** The jaguar (*Panthera onca*) and cougar (*Puma concolor*) are both threatened Species. Ecological Indicators Killed by local communities following attacks on dogs and livestock.

**Current Research:** Vertebrate monitoring system

### 6) Geotropically migratory birds

**Justification:** Each year, Belize is host to more than 200 species of migrant birds. By their very nature, migratory birds have become a symbol for the need of international efforts in nature conservation.

**Upcoming research:** Bird & vegetation surveys in CRFR

7) Engendered plant species **Justification:** Includes: 1 Critical species (*Zamia prasina*), 13 endangered species, and 17 vulnerable species. Little to nothing is known about the ecology of these plants and due to their rare nature, they are hard to identify.

### 8) Endangered river vertebrates

**Justification:** Includes Neotropical river otter (*Lontra longicaudis*) Central American River turtle (*Dermatemys mawii*), American (*Crocodylus acutus*) & Belize crocodiles (*Crocodylus moreletii*), may serve as indicators of ecological health.

**Upcoming research:** Proposed freshwater monitoring system

9) Primary timber species **Justification:** Mahogany (*Swietenia macrophylla*) and cedar (*Cedrela odorata*) both vulnerable. Threatened, especially by logging and fires

**Current research:** Vegetation monitoring system

**10) Secondary timber species** Justification: To ease pressure on mahogany and cedar populations, other species of timber can be used for a number of different uses.

Current research: Vegetation monitoring system

**11) NTFP species** Justification: high potential for income generation from forest using sustainable cultivation practices of many NTFP's. Current research: Xate population surveys of S. Belize

**12) Biodiversity of cacao plantations and other agro-systems** Justification: Widely credited with being biodiversity friendly, little information exists to support cacao's status as the ideal 'environmentally friendly' crop within Belize. **Future Species of Concern**

▪ Yellow headed parrot (*Amazona oratrix*) ▪ Keel billed motmot (*Electron carinatum*)

▪ Cerulean warbler (*Dendroica cerulea*) ▪ Giant anteater (*Myrmecophaga tridactyla*)

▪ Central American woolly opossum (*Caluromys derbianus*)

▪ Van Gelder's bat (*Antrozous dubiaquercus*)

## Barriers to Research

### ▪ Lack of scientific skills

▪ Especially: Identification & Taxonomy.

### ▪ Lack of access and housing for scientific literature

▪ Meerman's (2002) baseline analysis of the status of biodiversity within Belize found that out of 2534 studies, 80% of the papers could not be found in Belize.

(Appendix C)

*SATIIM'S Research Priorities*

Physical Studies

- ◆ Climate: rainfall, temperature, wind speed and direction, relative humidity, barometric pressure, tidal gauge and saline influences
- ◆ Flood patterns and effects
- ◆ Long term effect of fires on forest structure and soils

Chemical Studies

- ◆ Monitor water quality parameters including temperature, salinity, pH, turbidity and other relevant hydrological parameters of rivers that impact the park.
- ◆ Conduct studies to determine nutrient levels

Biological Studies

- ◆ Conduct studies of Flora and Fauna within the multiple use and indigenous use zones
- ◆ Monitor environmental impacts of the extraction activity
- ◆ Conduct detail studies of the ecosystem within the unique values zone
- ◆ Conduct studies on wildlife within aquatic systems and the impact of anthropogenic activity on aquatic wildlife populations.
- ◆ Research and monitor endangered or at risk species in the STNP.

Socioeconomic Studies

- ◆ Monitor land use changes within the park and buffer zone areas
- ◆ Monitor changes in natural resource use within the buffer zone communities
- ◆ Study the relationship between land use changes and the impacts on the aquatic systems
- ◆ Monitor changes in community perception of park and conservation objectives in general



***Sphagnum Mosses*** To conduct research on the size and ecological and hydrological processes of the Sphagnum Moss.

**Endangered or At Risk Species** To research and monitor endangered or at risk species in the STNP.

**Research Questions**

- ◆ To conduct research on the size and ecological and hydrological processes of the Sphagnum Moss.

💧💧 To monitor and research the comfrey palms (extracted specie) within the STNP.

💧💧 To research and monitor endangered or at risk species in the STNP.

## RESEARCH PRIORITIES FOR YCT, TIDE, SATIIM, AND STAKEHOLDERS

| Appendix D  |   | Ranking | FRESHWATER   | LAND MANAGEMENT  |                            |
|---|---|---------|--|--|----------------------------|
| <b>COASTAL AND MARINE PROGRAM</b>   |   |         |  |  |                            |
| <b>Cultural and socio-economic significance of marine and coastal resources</b><br>How do historical resource uses inform present day perceptions and practices?<br>What are the impacts to PHMR and PCNP and STNP on the social, cultural and economic life of the resource users?   | 1 | 1       | <b>How should we manage our watersheds</b><br>What are current practices and their impacts, documenting threats and severity of threats?<br>What are best practices?<br><br>What is an appropriate ecological riparian buffer?   | <b>Natural resource management</b><br>Evaluation of management effectiveness<br><br>Physical-geographic<br><br>Institutional evaluation<br>Ecosystem condition<br>Social indicators  | VH                         |
| <b>Water quality</b>  |   |         |  |  |                            |
| Oceanography- what are the sources and patterns of influence?<br>What is the water quality? Include more parameters (e.g. metals)   | 2 | 2       | <b>How good is our water</b><br>What are threats to surface and groundwater<br>How severe are they?<br>Where do they come from?<br>What is the most simple and direct way to monitor water quality - evaluate existing methods   | <b>Baseline data for (all) major taxonomic groups and species of concern</b><br>Game species<br>Timber species<br>Non-timber forest products<br>Sexy species<br>Indicator species<br>Physical environmental data (e.g. rainfall)                         | H<br>H<br>H<br>L<br>H<br>H |
| <b>Fish Recruitment</b>   |   |         |  |  |                            |
| Unit stock assessment (conch, lobster, lane snapper), snook, permit.<br><br>Biodiversity assessment<br>Fish toxicology<br>Is PHMR a nursery/recruitment ground for fish, lobster and conch? What is the population status of these species?<br><br>Are these populations genetically connected to regional populations (unit stock assessment?) | 3 | 3       | <b>What aquatic biodiversity do we have and how is it?</b><br>Need an inventory, population viability, resilience and level of sustainable extraction for select species including:<br>Hicatee turtle<br>Great Iguana<br>Food fishes   | <b>Structure and condition of ecosystems</b><br>Looking at structure and vegetation condition<br><br>Indicator species<br>General species composition of those habitats  | H<br>M<br>H                |
| <b>Coral Reefs</b>  |   |         |  |  |                            |
| Community composition (diversity, health, recruitment, impacts of climate change)<br>Is the status of coral, sea grass and mangrove community changing? If so what are the agents of change   | 4 | 4       | <b>What are good indicators of biodiversity health</b><br>How do we monitor these indicators?<br><br>Monitor non-indigenous species - including tilapia, <i>Hydrilla reticulata</i> (found in Guatemala, could be in Belize)   | <b>Establish a baseline for land use and land use change</b><br>Creating a detailed map of land use in area<br><br>Using at land tenure and mapping that<br><br>Mapping and evaluating the land use potential  | M<br>M<br>L                |
| <b>Sea turtles and manatees</b>   |   |         |  |  |                            |
| Habitat distribution and abundance, population ecology  | 5 | 5       | <b>Hydrology</b><br>What are the above and below ground water patterns?<br>What is the natural range of variability and current range of variability in flow availability?<br>What is target hydrology for this area?<br>How does current range compare to ideal?<br><br>What affects our water flow patterns<br>What are key areas that prevent flood control and are key for ground water infiltration | <b>Assessing and monitoring threats</b><br>Natural threats (Hurricanes, fires, flooding)<br><br>Anthropogenic threats (fires, logging, noise pollution, pesticides, extraction of on-timber forest products)<br>Extraction of non-timber forest products | L<br>H<br>L                |
| <b>Mangroves</b>  |   |         |  |  |                            |
| Nutrients and biomass, connectivity with fish nurseries   | 6 | 6       | <b>What is the value of water (economic and social)</b>  | <b>Social and economic uses of resources</b><br>Inventory of utilized species<br>How much of species is being used, by whom, how much is it used?<br>Environmental services<br>Alternative economic resources  | L<br>L<br>M<br>H           |
| <b>Sea grass</b><br>Community composition<br>Productivity   | 6 | 6       |  |  |                            |
| <b>Sooty terns</b>  |   |         |  |  |                            |
| Population biology (migration patterns, food sources, population)   | 7 | 7       | <b>What are transboundary issues in watersheds?</b>  | <b>Cultural Heritage</b><br>Inventory of archaeological and historic sites<br>Spiritual sites (e.g. Karst sites in SATIIM lands)   | M                          |

*(Appendix E)*

**Presentation of Biome Priorities**

Historical and current research, and identified research gaps

**A. Coastal**

1. Cultural and socio economic significance of marine and coastal resources
  - a. Research Conducted
    - i. Rio Grande Fishing Cooperative – TASTE-SCMR
    - ii. TIDE-PHMR socio-economic assessments
    - iii. Will Heyman – Voice of Fisherman (from Placencia southward)
    - iv. SATHIM Sarstoon Temash Area
  - b. Needs
    - i. SATHIM – socio economic study of marine area
    - ii. SCMR – socio economic study of marine area
    - iii. Answer research questions proposed
2. Water Quality
  - a. Ongoing research
    - i. TIDE collects data monthly but there is a need to include more parameters and collect data consistently
    - ii. TASTE started data collection three months ago but there is a need to include more parameters
  - b. Research collected
    - i. SATHIM – Hydrology study done but there is a need to monitor discharge from Sarstoon Temash
  - c. Needs
    - i. Three organizations need training on water quality testing
    - ii. Lack of human resources
3. Fish recruitment
  - a. Ongoing research
    - i. TR project – Sapodilla Cayes – fish recruitment, corals, lobster, But there is a need to include PHMR & SATHIM
    - ii. Annual conch, lobster, fish stock assessment by Department of Fisheries, but it needs to be done more frequently
    - iii. Peter Esselman is doing a nationwide study on tilapia
  - b. Needs
    - i. No reports have been produced on fish recruitment, there is an urgent need to have this to make management decisions
    - ii. Training is a need especially with staff turnover
    - iii. Minister of Forestry would like to see a study on the impacts of trawling
4. Coral reefs
  - a. Ongoing
    - i. Synoptic monitoring (MBRS)
    - ii. Sea grass and management studies by TIDE and SATHIM
  - b. Needs
    - i. Training is a need especially with staff turnover
    - ii. Need to include more sea grass sites

- iii. TASTE and SATIIM need to do more seagrass and mangrove studies to answer research questions

5. Sea Turtles

- a. Ongoing
    - i. SCMR has been ongoing for five years
    - ii. TIDE is recording sightings, distribution, and habitat with TRIGOH (turtles and manatees)
    - iii. Can Earthwatch take part?
  - b. Needs
    - i. SCMR- need to tag turtles and migration patterns
    - ii. SATIIM – manatee studies to answer research questions
    - iii. TIDE – expand TRIGOH turtles project to manatees
6. Sooty Tern
- a. Research collected
    - i. University of Alaska may have studied them
  - b. Needs
    - i. There is a need to study them because they are unique to Middle Snake Caye and Lime Caye – biology, migration patterns, 2000 birds ( Jan-Feb each year to nest)

**B. Land Management**  
**Natural Resource Management**

1. Baseline Monitoring / Species of Concern
  - a. Existing research
    - i. Game species YCT, SATIIM, TIDE biodiversity monitoring project
    - ii. Timber species YCT, Forest Dept, BFREE
    - iii. NTFP: YCT, SATIIM, BTFS,
    - iv. Indicator species: University of Alaska (seed dispersal by rodents), BFREE, U of Florida (frogs), MAYAMON
    - v. Charismatic species: WCS, Virginia Tech, Belize zoo (Harpy eagle), Peregrine fund (Scarlet macaw)
    - vi. Physical environmental data: Belize minerals (Brian Holland), hydrology, UB, YCT, SATIIM, TIDE, BFREE (weather station), Met service, Banana Growers Association, WRISC, BTFS
      1. gap: weather stations, Bladen is only in Toledo District
    - vii. threatened species: BERDS, U of Calgary (howlers), WCS, BTFS, YCT (xate, mahogany)
    - viii. invasive species: BTFS, BERDS (access information), BAHA
  - b. Needs
    - i. What is status of white lipped peccary?
      1. hunting pressure
      2. forest health
    - ii. What is status of cracids?
      1. YCT – hunted
    - iii. What is status of zamia?
      1. critically threatened
    - iv. What is population of hunters and harvesting frequency?
2. Social
  - a. Existing projects / resources
    - i. YCT projects have some social aspects (incorporated into outreach and agroforestry projects)
    - ii. TIDE has a specific program (small grants program)
    - iii. SATIIM recently hired environmental education officer (rangers have historically done the work)
  - b. Needs
    - i. How can we benefit from natural resource in the long term?
    - ii. How can communities be involved?
    - iii. How can public awareness / appreciation be improved?
    - iv. Dependability / importance of natural resources?
    - v. Archaeology
    - vi. Demographic changes in region over time, land use
    - vii. Sustainable Harvest would like to see market survey
3. Economic
  - a. Needs
    - i. What are current and potential resources that can provide alternative income?  
\*see social research priority areas\*

- ii. What are the social limitations to ecotourism development? Why has it not taken off in the Toledo region ? Infrastructure? Marketing? Social limitations – people not getting along, etc?
- 4. Agriculture and Agroforestry
  - a. Why do people not adopt techniques, change, etc?
  - b. Soil integrity
  - c. Land use and impacts (encroachment, biodiversity) – assessments
    - i. Can lead to alternative types of agriculture, crops
  - d. Assessment of agro-extension office project – has it worked? And what hasn't? Why?
  - e. Market
- 5. Threats
  - a. Sources
    - i. Political instability
    - ii. Population growth
    - iii. Lack of planning
    - iv. Short term economic gains
  - b. Actual
    - i. Land use change
    - ii. Fires
    - iii. Logging
    - iv. Unsustainable extraction
    - v. Pollution
    - vi. Natural
      - 1. What are key areas for protection (people and forests) against natural threats?

## C. Freshwater

1. Hydrology
  - a. Ongoing research
    - i. Freshwater initiative
    - ii. Philip Morgan (PCNP, 2005) ( SATIIM, 2003)
    - iii. ESTAP?
      1. UB has information?
  - b. Needs
    - i. Understanding of hydrology of Toledo watersheds
2. Baseline & Monitoring
  - a. Research collected
    - i. TIDE
    - ii. Belize Water Services
    - iii. UB
    - iv. ESTAP (data misplaced)
  - b. Needs
    - i. How good is our water?
      1. Standardized program for water testing (methods, reliable equipment)
      2. Develop community training (students) program for water quality testing
    - ii. What aquatic biodiversity do we have?
      1. Big gap Earthwatch could help fill
        - a. Peter Esselman (MR Base Tilapia)
        - b. TIDE/ UB Punta Negra
        - c. TIDE, PCNP
3. Managing Watersheds
  - a. Research collected
    - i. TIDE – impact mapping
    - ii. ESTAP – LU mapping
  - b. Needs
    - i. Baseline
    - ii. Landscape mapping
    - iii. ID of land use practices, impacts, and alternatives
    - iv. ID characteristics of riparian buffer
      1. size, condition
    - v. document results of awareness
4. What is the value of water (social and economic)
  - a. Research collected
    - i. Organizations could reprioritize water quality awareness
  - b. Needs
    - i. Assessment of values (flow, quality)
    - ii. Education of values of water
5. Transboundary Issues



**WORKSHOP PARTICIPANTS**  
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**Francis J. Ring S.J. Parish Hall**  
**September 25th-28th**

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