Community Manual

Darwin Initiative Guyana Partnership

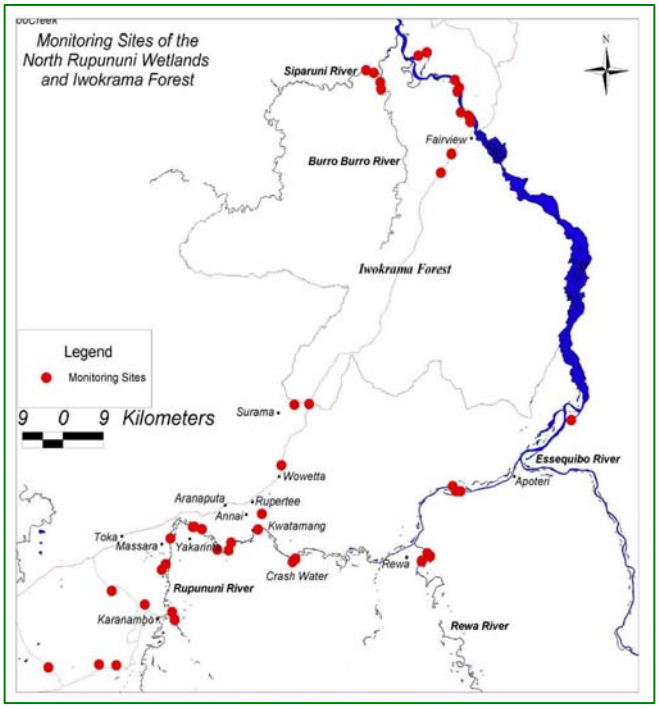
North Rupununi District Development Board
Iwokrama International Centre
University of Guyana
Environmental Protection Agency
Wildfowl & Wetlands Trust
Royal Holloway University of London
The Open University

INTRODUCTION

Purpose of Manual

The Wetlands Community Based Monitoring Manual is primarily aimed at providing guidelines for communities to implement a monitoring system for the wetland resources of the North Rupununi. This will help communities, interested in monitoring wetland resources, make informed management decisions regarding these resources.

It is also hoped that this manual will stimulate community participation and involvement in the monitoring and management of resources. This is important as the communities are the ones that are involved at all levels; from data collection, to implementing actions, to ensuring ecosystem balance, and also sustaining the way of life of people in the villages of the North Rupununi.
This document will provide a review of the concepts and monitoring techniques for the communities and further engage the communities with the Darwin Initiative sponsored project – *Sustainable Management of the Rupununi; Linking Biodiversity, Environment and People.*



The monitoring techniques described within this document are simple and cheap to implement as well as effective. The data collected by communities on their wetland resources can then be taken into consideration when decisions related to management of these resources are made by village leaders, the NRDDB, as well as the Government of Guyana.
The Wetlands project has collected a substantial amount of data with regards to the bio-physical aspects of 31 sites in the Rupununi Wetlands, since its commencement in 2004. This manual would allow for the continuity of monitoring of the Rupununi Wetlands, and will provide guidelines for communities to build their capacity to conduct this monitoring for themselves.

Fig 1 showing the sites that are part of the monitoring programme in the initial phase of the wetlands project ; Burro Burro River, Stanley Lake, Cowhead River Transect, 5 Mile Creek, 8 Mile Creek, Siparuni River ,Corkwood Swamp, Surama Lake Turtle Pond, Itch Pond, Marvin Pond, Diamond W, El Dorado, Lake Amoco, Airstrip Pond, Semonie Creek, Kwaimatta Landing, Iguana Pond, Yakarinta Pond, Yakarinta River Transect, Pgymy, Wagon River Transect, Devil Pond, Grass/Waimu Pond, Rewa River Transect, Rewa River Transect, Small Black Water Pond, Sand Landing River Transect.

DARWIN PROJECT SUMMARY

The Darwin Initiative Funded project, *Sustainable Management of the Rupununi; Linking Biodiversity, Environment and People* (The Rupununi Wetlands Project), has been operational in Guyana since January 2004. It brings together a range of institutions to build capacity in Guyana for the effective management of wetland resources. The project is designed to achieve this objective through the development of an adaptive management plan for the wetlands of the North Rupununi which will take into account biodiversity and environmental considerations and the people who depend on the resources of the wetland.

It is important to monitor the health of systems within the environment. In the process of environmental monitoring and the monitoring of resources, indicators are chosen, measured, and observed regularly to highlight any trends or sudden changes in the state of the system, population, or individual, and the use of resources over time. Trends associated are often related to the way people value an environment, and as such the cultural and social values are very important in setting "concrete"[1] environmental standards. These translate into guidelines that promote and foster the maintenance of the resources found within the Rupununi Wetlands.

This manual is aimed at providing guidelines for villages of the North Rupununi to conduct monitoring programmes in particular wetland areas.

The outputs from the implementation of this manual include:-

1. Accreditation[i] for communities doing monitoring
2. Information for future community resource plans for example quarterly reports at community level, reports to NRDDB, baseline and continuous assessment data to be used in the development of resource management plans
3. Updated maps of species distribution, and use within the region
4. Species lists and seasonal calendars of presence/absence of species within the area
5. Seasonal calendar of water quality within the region

Hello, my name is (Manong Carmela) and I am a young Makushi girl from the North Rupununi.

My people, and I wanted to share with you why it is important that we monitor what is happening in our Rupununi home. I just used a word *monitor* – Do you know what that means?

Monitoring our Rupununi home means that we keep making observations on what we have and what is changing in our environment on a regular basis. But monitoring doesn't stop there – when we make observation on how things are changing we have to then use that information to make good decisions on managing our Rupununi home.

When we show this kind of interest in our environment and people know that we are doing this to safeguard and ensure that we have water, fish,…for us to use tomorrow, then they too will pay attention to how important it is to monitor, and people will want come to us to show them how to take care of their environment and the wild things that we share our home with.

Fig.4 **What are Wetlands?**
These are different kinds of wet habitats where the land is wet for some period of time each year but not always permanently wet. Many wetlands occur in areas where *surface water* collects or where *underground water* discharges to the surface, making the area wet for extended periods of time.

[1] Concrete referring to strong or firm

THE PROCESS

The initial concept of the manual came from need and the requests from communities to have sites within their areas of use to be monitored. This was then followed by a review by the members of the project team, who live in villages of the North Rupununi, as to what parameters would be important to monitor for use in decision making within their home region. The technical manual was then adapted to meet these initial requirements for monitoring. This draft was sent to the fifteen communities of the North Rupununi for review by the villagers and village council to ensure that the initial indicators for monitoring are in sync with the needs of the communities of the North Rupununi Wetlands. Following this, the project team visited the communities to engage in discussions based on the comments made by the communities. At this stage, villagers were engaged in a village meeting at which the following six questions were asked:-

Fig5 Showing Community Manual sessions in communities

1. *Do you think it is important to monitor our wetland resources?*
2. *If yes, why is monitoring important?*
3. *What are some of the things that should be monitored?*
4. *How often do you think it is important to conduct monitoring exercises?*
5. *Whose responsibility is it to conduct monitoring of wetland resources?*
6. *What kind of support do you think would be important for your community to conduct its own monitoring of resources?*

These questions were asked to ensure the manual met the monitoring needs of the communities. The manual was then modified based on the responses to the questions listed above. Each village was then sent copies of this updated version of the manual, as well as a request for the villages to select six persons from within the community to form a review team. The review team discussion sessions further fine tuned the manual. The project team together with the six person review team from each community met twice and in some cases thrice to complete this final review of the document. This review entailed a reading of the manual in small sections, after the reading of each section; there was an explanation of what was just read followed by a question/answer session. In communities where persons were more comfortable communicating in Makushi, this was done in both English and Makushi. This phase was important in ensuring that the language used in the manual is appropriate for community members. This review phase also entailed the identification and modification of guides and species lists for monitoring. The lists were also translated so that the Makushi, Wapishiana and other local names were included.

In some villages, where the review panel was initially shy the team developed games to encourage participation. There were also situations in the review process where the sessions evolved into learning sessions on what monitoring is, and the importance of monitoring as well as why indicators are chosen in monitoring to understand how a bigger system works.

METHODOLGIES

The manual is a community implementation and education tool. This manual will provide a clear process for the implementation of practices for monitoring habitats, key species and land use impacts that communities can use in planning natural resource management. One recommendation is that communities involve the wildlife clubs and youth groups within the village in the collection of the required data. However, it must be emphasized that this monitoring process should not be the sole responsibility of wildlife clubs or youth groups if they are involved in this process, but rather it is recognized as a community activity to provide information of wetland resources for decision making by villages.

Data Collection Structure

Frequency of data collection

This manual proposes the following frequencies for data collection at sites chosen for monitoring by the village:-

1. Once monthly annually– This will provide the community with information for every month of the year. This will require a lot of time and resources to implement. The data collected every month is definitely beneficial, however the information that can be derived from it, can also be gained from monitoring less frequently.

Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry Season			Rainy Season				Dry Season			Small Rainy Season	
M	M	M	M	M	M	M	M	M	M	M	M

2. Twice in the rainy season and twice in the dry season annually – This will provide the community with information for both the rainy and dry season two times in one year. Monitoring at this frequency will require much more resources (food, transportation and time) than any of the other suggested monitoring frequencies.

Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry Season			Rainy Season				Dry Season			Small Rainy Season	
	M				M			M			M

3. Once in the rainy season and once in the dry season annually- This will provide the community with information for both the rainy and dry season one time in one year.

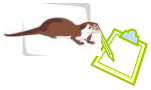
Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry Season			Rainy Season				Dry Season			Small Rainy Season	
	M					M					

4. Six times annually – This would provide the community with data twice in the rainy season, twice in the dry season as well as two times at the intersection between the rainy and dry season.

Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry Season			Rainy Season				Dry Season			Small Rainy Season	
	M		M		M		M		M		M

These timelines for monitoring have been recommended by communities who have had discussions on the Community Based Monitoring Manual. We are hoping to refine this as we continue to develop the manual to suit the monitoring needs of communities.

Each selected site should be monitored in the morning and the afternoon (to collect observations over a 24hr period).
Rainfall monitoring however, should occur once daily (please refer to section on rainfall monitoring).



Team Dynamics

The monitoring team should be selected by the villagers. The team should be made up of people who are responsible and have some capacity and can foster the development of monitoring skills.
If the option of using wildlife clubs or youth groups to conduct the data collection then wildlife club members should be a minimum age of 12years. The manual proposes a minimum of four wildlife club members/youths and one mature team leader for each site selected by the village for monitoring. If a community has more than one wetland site that requires monitoring on the same date, there should be more than one data collection team. The dynamics of the monitoring teams should always be balanced – ages should be mixed, to prevent only the youngest in a group and oldest in another group. The monitoring teams should also be balanced gender wise (two males and two females).

Tasks Rotation

Within the monitoring team, it is proposed that tasks be distributed and rotated to ensure efficient and effective collection and management of information.
Tasks include:-

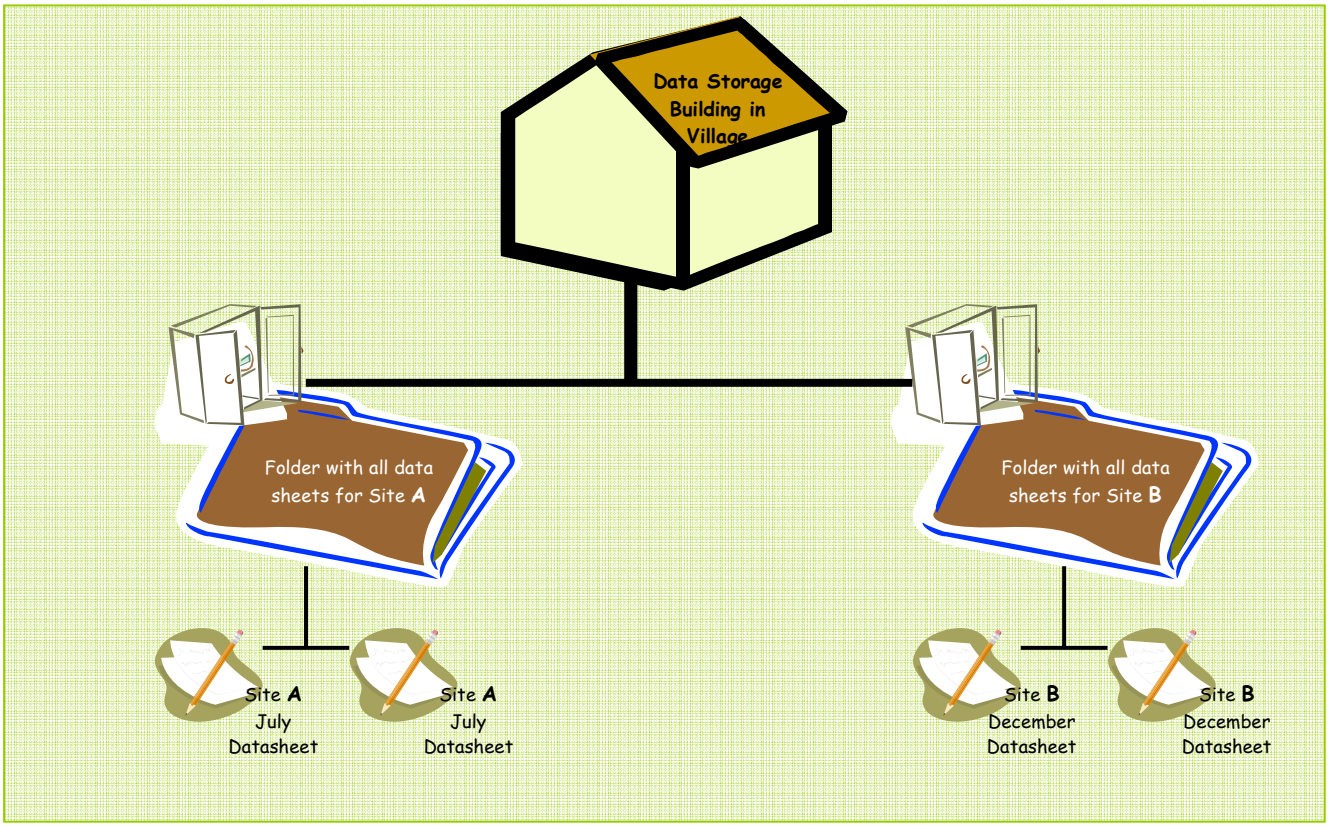
1. **Equipment and Ration Coordinator** – Responsible for arranging food, field gear (binoculars, datasheets, pencils, measuring tape, bird guide, fish identification charts).
2. **Scribe** – One person of the team filling the datasheet in with information and observations collected by the team.
3. **Observers** – All members in the team are responsible for collecting observations.

The equipment and ration coordinator can be a shared responsibility between two persons.
The task responsibilities should be rotated, so that everyone from the group will be given the opportunity to scribe as well as organizing the rations and field equipment.

Hello, remember me - Manong Carmela. Here is our checklist for preparation of equipment and food for data collection:

1. Datasheets
2. Pencils and Pens
3. Clip Board
4. Plastic bags to store data sheets
5. Binoculars
6. Measuring Tape
7. Insect Net
8. GPS
9. Identification Charts
10. Watch
11. Food
12. Cooking Utensils
13. Torch light
14. First Aid Kit
15. Extra batteries
16. Matches
17. Small Tarpaulin

Data Storage



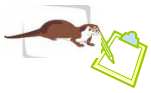
Data storage is important and as such a secure place should be earmarked to store the data collected. This area should be known by all the members of the monitoring team as well as the key stakeholders who are village decision makers. The responsibility of the data storage should be shared and not left as the responsibility of one individual. One week upon collection of the data, the completed data sheets should be placed in location identified for data storage. For example data collected in one month should be in the data storage location the following month.

Within the designated data storage location, there should be folders that are clearly labelled with the sites that are being monitored. The datasheets for those sites, upon completion are then filed in their appropriate site folders.

At the end of each monitoring session, the mature member of the monitoring team or a member of the decision maker/data user should make sure that data is stored correctly.

Makushi girl talking about the North Rupununi Wetlands

Site Specific Monitoring



Site selection criteria

Prior to the implementation of any component of this manual, communities interested in monitoring wetland resources, should highlight the specific benefits of the monitoring of the selected sites.
The criteria for selecting a wetland site to be monitored include:-

a. Important to the Community – The sites chosen to be monitored by the village should be important in terms of resource use around the wetland area. The following is a list of factors to be taken into consideration:-

   - *What are the current resource uses of the site?*
   - *What are the potential long term effects on these uses on the wetland system?*
   - *What are potential or planned uses and their associated effects?*
   - *What are the cultural beliefs associated with the site?*
   - *What animals and plants depend and use the site, for example as nesting grounds?*

b. Logistically sound – It is recommended that the safety of the monitoring team as well as the accessibility of sites be taken into consideration when site selection is being done. The site/s should be easily accessible from the village, and should require minimal travel. This would reduce/negate any financial costs associated with accessing the site. The sites should not pose any danger to the monitoring team, and should be easy to leave in the case of any accidents/incidents. In the site selection the following should be considered:-

   - *What is the distance from the village to the site?*
   - *What would be needed to allow for the monitoring of the site?*
   - *Is it easy to leave in the case of an emergency?*
   - *How much time would be needed to travel to the site?*

Based on the criteria above, the manual recommends that the final decision on selecting sites to be monitored is made by the community members. It is recommended that this decision be made so that the resources available to the community for monitoring are used to the best possible outcome for informing decision making processes in the community.

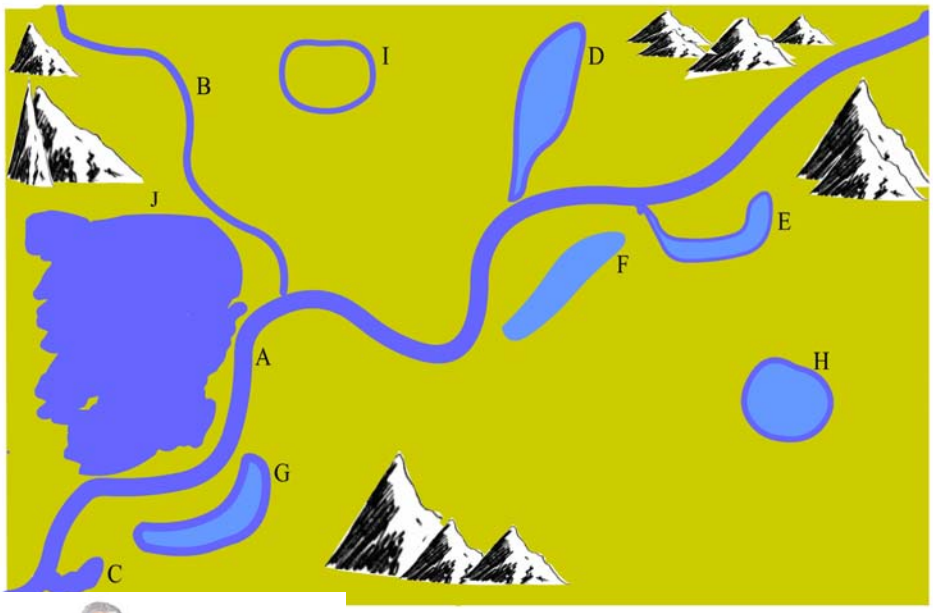
Hi, I wanted to share some of the possible scenarios for selecting a site:
1. An area/pond/section of river that the community wants to use for tourism for example places that are nesting and feeding grounds for birds, caiman, otters, fishes, and turtles.
2. An area/pond/section of river that is being used by the village as a main fishing/hunting/gathering location.
3. A place that animals use as a migration route for breeding.
4. An area that is being earmarked for community conservation area.

Choosing and classifying wetland sites

Before commencement of monitoring activities, it is important that an initial description of the wetland is made.
The wetland site chosen should be grouped, based on the following classification scheme:-

a. Type of wetland – There are four main groups into which wetlands can be classified. These are ***river***, ***pond or lake that floods directly from river***, ***pond or lake that flood back up small creeks from river*** and ***basin ponds***.

CLASSIFICATION OF WETLAND AREA



Legend
Names include the terms used to identify waterbodies in the Rupununi

A - Main River Channel (SC), Big River (LC), Itesa (M)
B - Creek (SC), Creek (LC), Iwîtî (M)
C - Cut -off channel (inlet with connection to river)[SC], Bay(LC), Yawaîn (M)
D - Former Channel (separate from river)[SC], Old River or River Pond (LC), kupî (M)
E - Ox-bow Lake (with a connection to the river)[LC], River Pond (LC), Ipu' pîn painon (M)
F- Former Channel (separate from river) [SC], Lake (LC), Itesa sinkutî pî (M)
G- Ox-bow Lake (separate from river) [SC], Old River or Lake (LC), Itesa sinkutî pî (M)
H - Permanent Pond (SC), Pond (LC), Kanaipîn (M) or Pakkei pepin (M)
I - Pond that dries out (SC), Savannah Pond (LC), Pakkei (M)
J - Flooded area (SC), Swamp, or Flooded Savannah (LC), (M)

My friends, here are some examples of these types of these different kinds of wetlands that we use everyday in the North Rupununi
A – Rupununi River, Rewa River
B – Crashwater Creek, Semonie Creek
C – Pygmy, Stanley Lake
D- Devil Pond, Yakarinta Pond
E – Turtle Pond
F- Small Black Water Pond, Grass Pond
G- Cajeiuro Pond
H- Airstrip Pond, Surama Pond
I- Iguana/Oma Pond, Itch Pond
J – Rupununi Low Savannah areas

Fig 9. **Importance of Wetlands**
Wetlands have many ecological functions, such as removing sediments and pollutants from surface waters, and reducing flood impacts by slowly releasing excess water back into the creeks, rivers, ponds and lakes, and by slowly releasing excess water back into the water table. Wetlands are usually rich in biodiversity that are not found in drier habitats. Properly managed wetlands can provide important resources for people and many animals and plants.

b. Type of habitat[2]

This section is focused on the general description of the habitat found around the wetland within the Rupununi Wetlands. Habitat types are:

i. *Forest – Flooded Seasonally* -A dense growth of trees, plants, and underbrush covering a large area that gets flooded in the rainy season every year.

ii. *Forest – Flooded Cyclically* - A dense growth of trees, plants, and underbrush covering a large area that does not get flooded in the rainy season every year, but rather gets flooded in the rainy season with a six-eight year gap.

iii. *Forest –Non Flooded* - A dense growth of trees, plants, and underbrush covering a large area that does not get flooded seasonally, nor after a six-eight year flood cycle.

iv. *Savannah – Flooded Seasonally* – A grassland area with widely spaced trees that gets flooded in the rainy season every year. Grasses and trees are the main vegetation types, with trees and grasses often alternating in dominance over time. There is usually a mixture of grasses and herbs with trees and shrubs scattered individually or in small clumps.

v. *Savannah – Flooded Cyclically* - A grassland area with widely spaced trees that does not get flooded in the rainy season every year, but rather gets flooded in the rainy season every six-eight years. Grasses and trees are the main vegetation types, with trees and grasses often alternating in dominance over time. There is usually a mixture of grasses and herbs with trees and shrubs scattered individually or in small clumps.

vi. *Savannah – Non Flooded* - A grassland area with widely spaced trees that does not get flooded seasonally, nor after a six-eight year flood cycle. Grasses and trees are the main vegetation types, with trees and grasses often alternating in dominance over time. There is usually a mixture of grasses and herbs with trees and shrubs scattered individually or in small clumps.

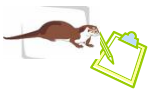
Fig 10 Section of riverine seasonally non-flooded forest

Fig 11 Section of riverine flooded forest

Fig 12 Section a flooded savannah area

Fig 13 Section of non flooded savannah

Sections A and B, all describe the methods of developing the initial general description of the site. This is done once, at the initial stage of monitoring. Other observations, of any changes should be made as they occur.



Parameters for monitoring wetlands

Upon the completion of the initial classification of the site in the wetland and habitat class, and the determination of the monitoring frequency for the site, the community monitoring team can then proceed to commence the data collection process for the community wetland monitoring programme.

[2] Habitat -place where an organism or a community of organisms lives, including all living and nonliving factors or conditions of the surrounding environment.

The following section includes descriptions and methodologies for data collection for the wetland sites chosen by the community.

1. Vegetation (plant) parameters

A. The presence or absence of vegetation on the banks of the waterbody are grouped into:-
i. Vegetated bank (if there are plants), or
ii. Unvegetated bank (if there are no plants)

If the bank is classified as vegetated, these are the main groups of plants found on the waterbody bank:-

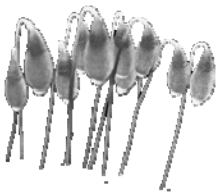


Fig.14 Byrophytes / Moss

Fig.15 Tall herbs

Fig 16. Grasses

Fig 17. Creeping Grasses

Fig. 18 Scrubs

Fig 19. Trees and Saplings

B. The type of flora (plant) that can be found within the waterbody itself is important. The types of plants that can be found within the waterbody itself include emergent, and submerged plants.

Fig 20 Example of emergent plants in a waterbody

i. Emergent plants are those plants that grow with their roots earthed into the bottom in the waterbody and lower stems in the water, but they also have stems and leaves above the surface of the water.

ii. Floating Plants are those plants that are found floating on the surface of the water.

iii. Submerged plants are those plants that have all of the parts below the surface of the water.

There is also a special group of plants called algae. Algae are simple rootless plants that grow on the surface of the waterbody. They lower the *dissolved oxygen* in the water, and they are food for small fish and small water animals.

Fig 22 Example of submerged plants in a waterbody

C. The extent of the plants, and plant features at the wetland site can be classified into the following groups. These include:-

i. Scattered – This refers to when the plants on the bank/s of the waterbody are found far away from each other.
ii. Regularly spaced – This refers to when the plants are found in small clumps all around the bank of the waterbody with the distance between the clumps similar.
iii. Continuous – This is when the banks of the waterbody are covered with vegetation throughout.
iv. Semi-continuous – This is similar to continuous, but there are small sections on the bank that do not have plants, but then after that section there is a section with plants.
v. Overhanging trees – These are the trees, that have branches that hang directly over the waterbody.
vi. Exposed roots on the bank – This refers to roots that are no longer covered with soil on the bank of the waterbody.
vii. Underwater roots – This refers to those plants whose roots may be found under the water. For example in the rainy season when the forest and savannah gets flooded, many plants' roots are found underwater.
viii. Fallen trees and woody debris – These are the trees that might have fallen into the waterbody, as well as the branches of trees that have broken off of trees that are still standing.

Hello, Manong Carmela here again – Earlier in the manual we talked about the Darwin Wetlands Project. This project has developed a basic list of the plants that could be found on the banks of the wetland sites in the North Rupununi region. These include *Wallaba , Mora, Bamboo, Scrub,Lana,Aripipi Palm,Water Cedar,Whitee, Old Man Back,Guavaballi*. Remember though these are not all of the trees that can be found, there are many others that we know.

Fig 23 Showing an eroding bank

Fig 24 Showing a stable earth bank

2. Substrate (soil) Parameters

A. The bank/s of the waterbody can be grouped into two categories based on the eroding action of the water in the waterbody. These are:-

i. Eroding bank -when the soil is being washed away and there is loose soil that keeps falling off of the bank into the water.

ii. Stable earth bank - when the soil is not being washed away.

B. The types of soil found in the wetland area can be:

• saturated by permanent flooding,

• seasonally flooded, or

• occasionally covered with a small amount of water.

When wetland soil remains wet long enough, the upper soil layers are deprived of oxygen and become anaerobic. Over time, this lack of oxygen results in chemical reactions that change the soil's color, texture and what it is made up of.

During the dry season when water is not present, the color of soil can be used to identify an area as a wetland. By understanding soils and the seasonal changes in the soils, information about the duration (length) and frequency (how often) of wet season conditions can be gained.

Wetland soils are divided into organic or mineral.

i. Organic soils look like black muck or dark brown or black peat. The color of organic soils is as a result of rotting plants and animals.

ii. Mineral soils do not have organic material. Some examples of mineral soils are sand, silt, and clay.

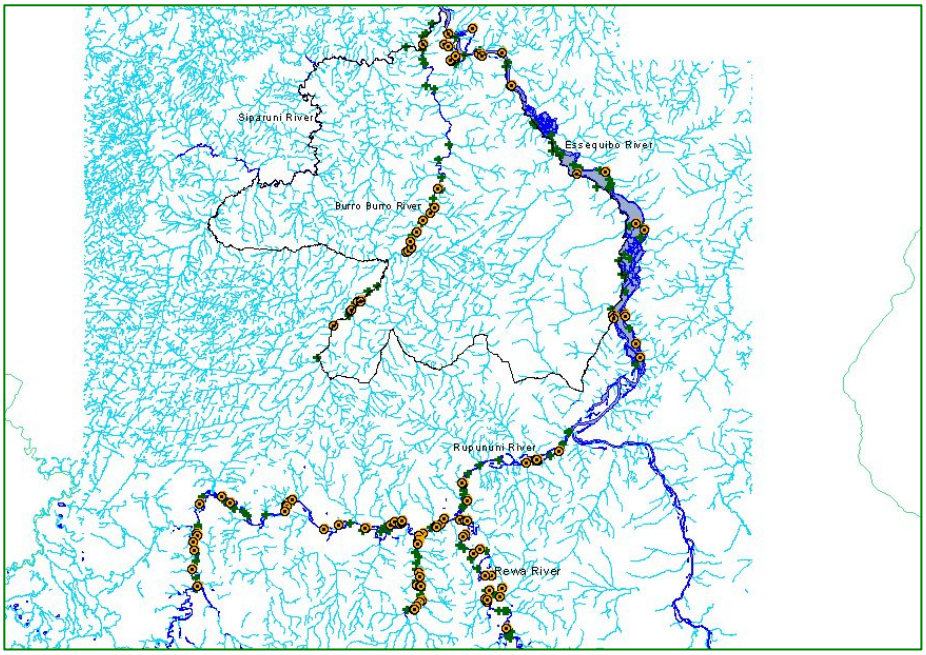
Identifying Sand	Identifying Silt	Identifying Clay
PARTICLE SIZE: .05 mm to 2 mm COMPACTION: Low SUSPENSION: When soil is suspended in water, sand particles will settle first. TEST: When moist, the sand will not form a ball when squeezed together and will fall apart instead. Sandy soils are porous and usually hold less water for plants and animals than any other soil type. Areas with sandy soils are very easily affected by erosion.	PARTICLE SIZE: .002 mm to .05 mm COMPACTION : Medium S U S P E N S I O N : When soil is suspended in water, silt particles will settle after sand, but before clay TEST: When moist, silt cannot be pressed into a ribbon Silty soils hold both nutrients and water, which in turn can make them good soils for plants to grow. Areas with silty soils are very easily eroded by wind and water	PARTICLE SIZE: Less than .002 mm COMPACTION : High SUSPENSION : When soil is suspended in water, clay particles are generally the last to settle TEST: When moist, clay can be pressed into a strong ribbon Clay soils are not very good for plants to grown on, as because of the closeness of clap particles, roots are harder to grow. Areas with clay soils can be more eroded easily.

The bottom substrate is the type of soil that is found in the waterbody itself. These include:-

i. Boulder (large rocks in the waterbody) - solid rock fragments that are wider than 6 meters (20 feet)
ii. Gravel/Pebble
iii. Sand
iv. Clay
v. Silt/ Mud – Clay with a small amount of sand, less smooth than clay.

Fig 25 Showing Boulder in Essequibo River

This soil information is collected by scooping a sample of the soil from the bottom of the waterbody, and examining it using the soil guides above. The soil type of the waterbody being monitored should be examined and recorded from the same location, every monitoring session.



Some special plants and animals have their homes within these North Rupununi wetland areas.

These include:-

Kokerite Palm
Ite Palm
Big Water Lily (Victoria amazonica)
Small Water Lily (Nymphaea)
Guavaballi
Maaho – (Spetual spp)
Moco moco (Montrichardia arborescen)
Aripipi Palm Aserocaryum spp
Water Hyacinth Eichhornia crassipes
Busy Busy (Spiked rush)
Tapir (Tapirus terristris)
Black Caiman (Melanosuchus niger)
Giant River Turtles (Podocnemis expansa)
Fishes, and of course me and my family – Giant River Otters (Pteronura brasiliensis)!

This map shows where we have our campsites (territorial marking playing, eating places) and our dens (where we sleep) along the Rupununi, Rewa, Essequibo and Burro Burro Rivers.

3. Hydrological (Water) Attributes

The attributes of the waterbody with regards to the hydrology that can be monitored include: -

A. *Hydrological inputs* and *outputs* refer to how and where the waterbody gets water and looses water.

These are the possible hydrological inputs: -

i. G*roundwater discharge* refers to water that comes up from below the earth's surface from the water table.

ii. *Surface runoff* refers to water that flows off of the earth's surface into the waterbody.

iii. *Surface overbank inundation (flooding) from a river or from a rise in water level of a waterbody* refers to water that flows into one waterbody from another

iv. *Precipitation* refers to rain, and or dew.

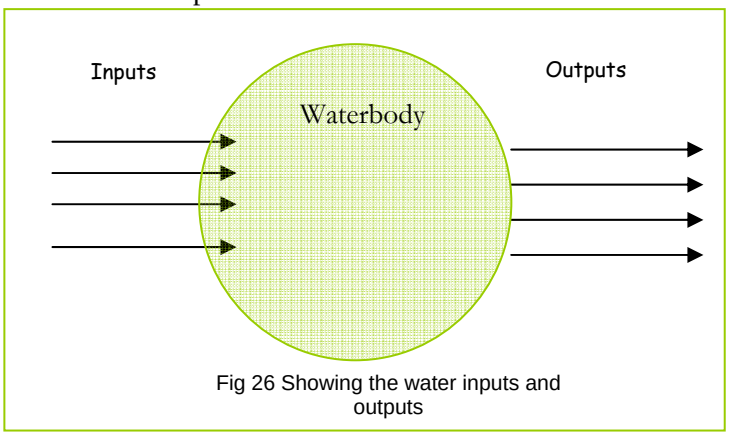


Fig 26 Showing the water inputs and outputs

These are the possible hydrological outputs:-

i. *Evaporation* refers to water that is lost from the surface of the waterbody as vapour.

ii. *Transpiration* refers to water that is lost from the waterbody, as plants take water up via their roots for processes of photosynthesis (food making), then giving water off as a waste product to the atmosphere.

iii. *Groundwater recharge* refers to water that is returned from above the earth's surface into the water table.

iv. *Surface runoff* refers to water that flows out of the waterbody into another

The hydrological inputs and outputs for a site can be a combination of all the listed inputs or a few of those listed.

B. *Flooding Regime* refers to the presence or absence of water in the waterbody. There are two options:-

i. Water Present

ii. Water Not Present.

C. *Water Colour* refers to the colour of the water in the waterbody. Water colour can be recorded as black, white, clear or brown.


Fig 27 Showing example of Black

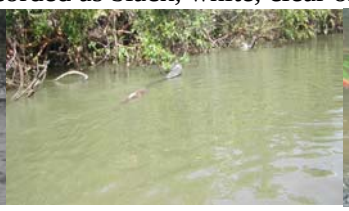


Fig28 Showing example of White


Fig 29 Showing example of Clear


Fig 30 Showing example of Brown

Water is very important to human life and to the health of the environment in which we live. As a valuable natural resource, it makes up many different types of habitats including freshwater systems (river and lakes- where we live) and groundwater environments, across coastal and inland areas. The quality of the water is usually described according to four headings:- physical, chemical (what it is made up of), biological and aesthetic (how it looks and smells) A healthy environment is one in which the water quality can support a rich and diverse community of organisms and protects the health of the communities that use the water. If water quality of our rivers and lakes in the Rupununi is not maintained and kept healthy, it is not just the environment that will suffer – but the commercial and recreational value of our water resources will also be reduced.

D. *The characteristics of water are used to indicate the quality of water*. The water quality indicators can be grouped as:

- *Biological*: macro-invertebrates, bacteria, and algae
- *Physical*: temperature, turbidity and clarity, colour, salinity, suspended solids, dissolved solids
- *Chemical*: pH, dissolved oxygen, biological oxygen demand, nutrients (including nitrogen and phosphorus), organic and inorganic compounds.
- *Aesthetic*: odours, taints, colour, floating matter

Measurements of these indicators can be used to determine, and monitor changes in, water quality, and determine whether the quality of the water is suitable for the health of the natural environment and the uses for which the water is required.

Water quality is usually measured using meters. These meters can record the *pH* (acidity or alkalinity), the *turbidity*, and *dissolved oxygen*, of the water. These values tell how healthy the water is to sustain life. However, the meters to record these values are usually very expensive.
An alternate approach is biological monitoring that would provide information on the health of the water body based on the presence and/or absence of small invertebrates.
This method involves the identification and classifying of invertebrates into groups. This method of aquatic monitoring gives a rapid assessment of the water quality and habitat parameters within the system. The difference and the quantity of macro-invertebrates can then be used to understand the quality of the water body.
Macro-invertebrates that are important in monitoring the water quality include aquatic insects, and other arthropods that live in different habitat types within the water body.
Most of these organisms derive their oxygen from the water in addition to a minimum quantity of air. Macro-invertebrate sampling allows both natural and artificial impacts to be recognized, so that actions, if possible, can be taken to remediate the situation.
Macro-invertebrate sampling shows effects of both short and long term impacts, as most life cycles of such invertebrates range from one year to several.
Macro-invertebrates can be found within many kinds of habitats including places where shallow water flows quickly over rocks, accumulated leaf litters, roots hanging into the water, old wood or logs, and the streambed.
The method that can be used to conduct this macro-invertebrate monitoring include:-

1. Selecting Sampling Areas – There should be at lease three areas selected within the wetland site that is being monitored for macro invertebrate sampling. These areas should include areas that will allow for the examination of the bottom substrate, woody debris/vegetation at the edge of the waterbody and for waterbody surface examination. The same areas should be sampled at each visit to the site that is being monitored.

Fig 31 Showing sampling area selection at a waterbody

2. Techniques for sampling areas:-

i. Bottom Substrate Sampling:- Within sites selected look for an area where the water is

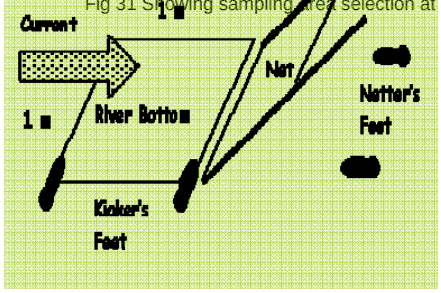


Fig 32 Showing Kick Sampling Methodology

about 3 - 12 inches. Begin by placing a net in a location downstream from where a team member is standing. The net should be firmly placed into the streambed, securing the bottom edges with rocks. The net should also be attached to a stick that another team member should hold to keep it secure. Then the team member upstream from the net should begin kicking the upper layers of substrate in the water to dislodge any invertebrates. The duration of this should be for three-four minutes. Any loose debris should be rubbed off rocks, and sticks caught so that most invertebrates will be collected off the sticks into the seine. After doing this the net should be lifted out of the water, being careful not to lose any of the debris containing macro invertebrates caught in the net. Rocks and sticks found should be examined thoroughly for invertebrates before being discarded.

ii. Water Surface Sampling: - Within the monitored site, select an area of the waterbody where, a dip net is taken and the top 20 cm on the water surface is sampled for any invertebrates that might be present on the surface of the water. The area to be sampled should be 1m*1m. The time spent doing this should be between three to four minutes.

iii. Woody Debris/Vegetation Sampling: - At the waterbody being monitored, a 1m*1m area of vegetation on a bank of the waterbody should be sampled. This are can be sampled by shaking the branches of the plants with a dip net and collect any macro invertebrates that might be on the vegetation. Stems and branches should also be examined for the cases on invertebrates that might have already completed metamorphosis. Additionally, six handfuls of old decaying leaves found next to rocks or logs in this same area should also be collected and added to the sample. The time

Upon completion of sampling of each of the three areas within the site, the team should spend not more than thirty minutes going through the samples, to identify and record the macro invertebrates caught. The samples should be separated for accurate identification of macro invertebrate type.

D. *Water Body Features*_- This refers to the water depth, water body width, water body length, of the water body.

These observations must be made and recorded in the morning and the afternoon when the site is being visited for data collection.

These will allow for an understanding of how the water level fluctuates over the year.

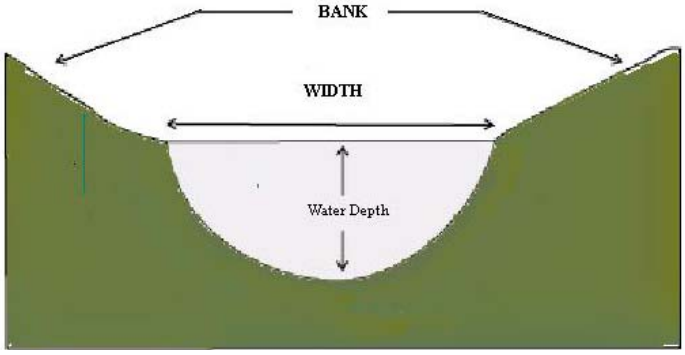


Fig 33 Showing waterbody width, depth and banks

i. Water depth data should be collected in keeping with the following guidelines:-

a) One spot chosen to collect water depth data throughout the year. This spot should be accessible in the dry and rainy/flood season.

b) Water depth readings should be taken morning and afternoon per site visit using meter as the unit of measurement.

ii. Water body width measurements should be collected at the same point of the water body at each visit to the site.

For the purposes of monitoring water body width refers to the distance covered with water from one bank to the other.

iii. Waterbody length refers to the distance along any one of the banks in meters.

In the case of the rivers and creeks, where a distance of 1km is selected to be monitored, the waterbody length will be 1km – even though the distance of the waterbody might be longer than that.

4. Rainfall Monitoring

As rainfall data is collected and accumulates, long-term trends in the rainfall quantity can be analyzed and used as a basis of comparison to other kinds of data collected, including animal population changes, and the availability of resources. This will be very crucial to the management of the wetland ecosystem of the North Rupununi.

The North Rupununi is characterised by two rainfall seasons, one from May- July (during which time the region receives the most amount of rain) and the other which occurs during December – January (during this time the rainfall is reduced to around 50mm per month). Rainfall during the wet season in most parts of the Rupununi savannahs typically exceeds approximately 300-400 mm.

The rainfall data that is collected by communities can be used to make decisions on the availability of resources and can also inform decisions on farming and fishing activities. Additionally, if communities collect rainfall data it can be used by the Guyana Meteorological Office in understanding the rainfall for the entire country.

Setting the Rain Gauge –
The rim/top of the rain gauge should be set one meter above ground.
The rain gauge should be set in the centre of an open area, and should not be set close to buildings and trees as this can affect the accuracy of the data collected.

Collecting the data –
The rain-water that is collected in the rain gauge is poured into a measuring cylinder and the amount recorded in the data sheet. The persons collecting the rain data can be rotated monthly, so that no one person is responsible for this for an entire year. At the end of the month, the responsibility for collecting the rain data can be handed over to the next person. A suggestion is that the village nominates someone at village meetings to man the rain gauge.

Frequency of data collection-
Rain data should be collected everyday at 0800 hrs (8am).
The data collected today should be recorded as the rain data for the previous day

In collecting rainfall data – here is a checklist of information that is important for us to collect

Location: This is where the name of the village is to be entered
Date: The date the observation was made.
Time: The time the observation was made.
Amount rainfall / ml: The observer records the amount of rain fall in millilitres.
Recorder name: The name of the person that took the measurement of the rainfall must also be recorded.

I know that we all know when rain will fall a lot and when it will not – but don't you think it would be a good idea to start writing it down, so that we can check back 10 years from now, to see how our rainfall has changed.

5. Wildlife Parameters

A. Bird Monitoring

Bird surveys help us to understand how bird species and numbers vary throughout the year. From this we can then learn how the different species respond to differences in habitats and the availability of food and areas for foraging[3], hunting or breeding[4]. Some birds remain all year round at the same location while others migrate[5]. All of this information is important in addressing the possibilities for use of the wetland by the community as well as the conservation issues for the different species.
A bird list can be developed by the community for monitoring. This species list can include birds that are found in wetlands as well as birds that are of interest for community use, for example if the community is interested in birds that are tourists attractions, or if they are working on supporting the survival of a species that might be facing threats, or if the species is important as a source of protein.

For each visit to the wetland sites, chosen for monitoring, bird surveys should always be carried out between 06:00 hrs and 08:00 hrs and 16:00 hrs and 18:00 hrs. These hours are usually the peak activity hours for birds. The duration of the survey should be forty five minutes.
It is important that the following information is observed and recorded:

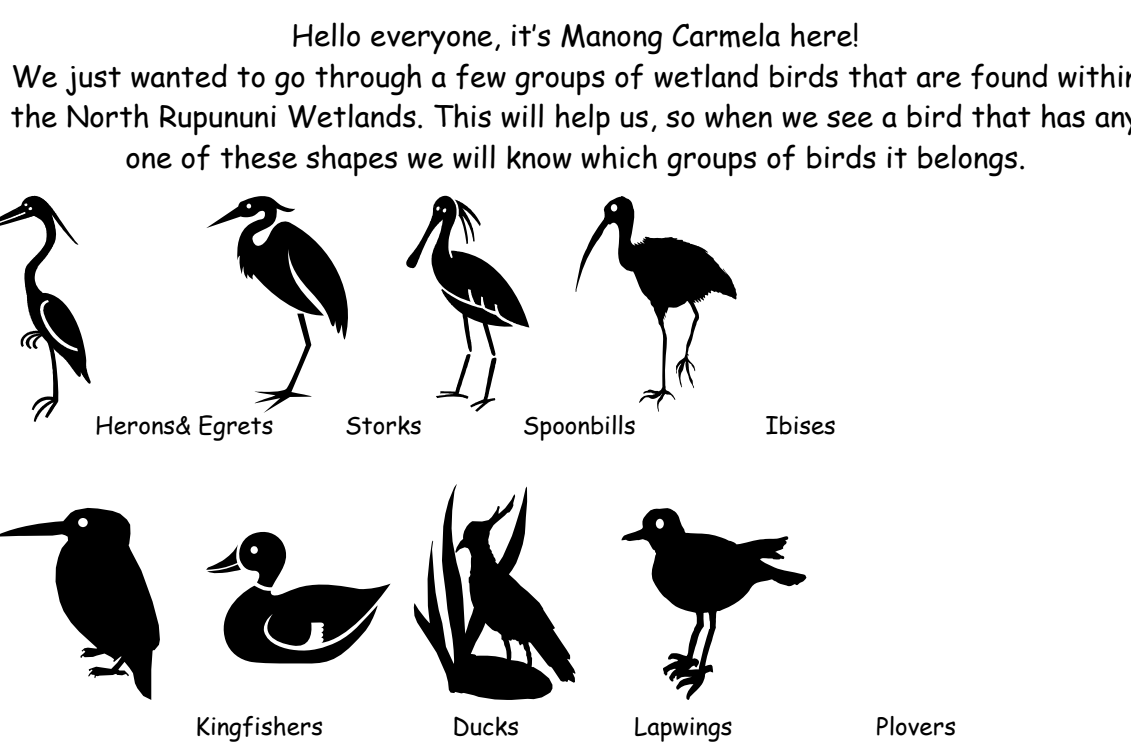
a) Time start and Time finish
b) Name of site
c) Date
d) Weather - categories include sunny, cloudy, rainy
e) Observers names (members of monitoring team) and recorder (person writing the observations)
f) Disturbance – Categories for disturbance include Weather, Animals, People, or Other as well as No Disturbance.
g) The English Common Name of the bird seen
h) The total number of birds of each species seen.

Fig 34 Showing Bird Survey Methods

The method of conducting bird surveys is dependent on the type of monitoring site.
a) For ponds and lakes – Cover the circumference of the pond or lake and record all birds seen and heard in a canoe, or stand at one point (remains the same for each visit to the site), where visibility of the waterbody is more than 75%, for the duration of the survey (45 minutes) and record all birds observed.
b) For river and creeks – Paddle to cover 1km distance within 45 minutes, and record all birds seen or heard in the 1km transect. Observations can be made either going upstream or downstream along the 1 km transect.

[3] Foraging means feeding
[4] Breeding means to reproduce
[5] Migrate refers to the movement made between two location, from one to the other and vice versa

c) For seasonally flooded areas - Walk or paddle to cover a 1 km distance in 45 minutes, and record all birds seen or heard. This is suggested as there are some areas that get completely dried out in the dry season, so a canoe cannot be used.



B. Incidental Wildlife Observations

Wetlands provide a range of wildlife habitats for a large diversity of life and are also important links between other types of habitats.

The following information should be collected and recorded in incidental wildlife observations:-
a) Name of species observed
b) Number of individuals of each species observed
c) Activity (what's it doing for example feeding, running, playing, grooming etc.). If the animal is observed feeding, then notes should also be made on what it was feeding on.
d) The time and duration of the wildlife sighting.
e) The location of the animal when it was observed.

C. Caiman Observations

There are four species of caimans that can be found in the North Rupununi. These are the Black Caiman (Melanosuchus niger), Spectacled Caiman (Caiman crocodiles), Schnider's Dwarf Caima (Paleosuchus trigonatus) and Cuvier's Dwarf Caiman (Paleosuchus palpebrosus). If the community would like to implement a monitoring system for Caiman, the manual recommends that the surveys be done with utmost care and every precaution taken to ensure the safety of the monitoring team.
In caiman monitoring, the manual recommend that emphasis be placed on the Black Caiman and the Spectacled Caiman.

The Black Caiman is the largest of the caimans found in Guyana and can grow to lengths greater than 6 metres. The Black Caiman keeps its distinctive skin markings into adulthood: they have grey or brown bands on the lower jaw, and display white or yellowish bands on the sides of the body. The Black Caiman lives in freshwater particularly favouring quiet back waters, bends of rivers, ponds, lakes, lagoons, flooded forest and savannahs. This reptile is mainly nocturnal but can be seen during the day. They feed on fish and other aquatic vertebrates. The breeding period of the Black Caiman is said to be between September and December. During this time the populations of Black Caiman are dispersed amongst a wide expanse of its range. During the dry season when the water levels recede, flooded savannas dry, and the Black Caimans are found in greater numbers in the river, permanent ponds, and lakes

The Spectacled Caiman is the second largest caiman in Guyana and can reach lengths of up to 2m. This reptile gets its name from a bony ridge that is present between the front of the eyes, appearing to join the eyes like a pair of spectacles. Juveniles are yellow in colour with black spots and bands on the body and tail. As they mature, they lose this yellow colour and the markings become less distinct. Adult Spectacled Caiman are dull olive-green. The Spectacled Caiman is an extremely adaptive species and can be found in virtually all lowland wetland and riverine habitats. The juveniles of this species take a variety of aquatic invertebrates including insects, crustaceans, and molluscs. As they grow, various vertebrates take up a greater percentage of the diet. These include fish, amphibians, reptiles and water birds.

The caiman surveys can be are conducted using the spotlight method. This method would involve the monitoring team using powerful torches to conduct the surveys. The surveys should be done after 19:00 hrs to increase sightings of caimans.

The Spectacled Caiman can be identified by a whitish eye shine while the Black Caiman has an eye shine that appears coal red.

It is important that the following data is collected:-

i) Species
ii) Approximate head size or total body size (if possible) - Length measurements are calculated by lowering a stick of a known length alongside the head of the caiman.
iii) Time observed
iv) Number of individuals seen
v) Any other comments.

<u>For river sites that are being monitored</u> - the same 1 km transect that is used for the bird surveys can be used. The observers paddle along the transect using the torches to look for eye shine. Paddling will allow the monitoring team to get closer to the animals to estimate size and verify identification.

<u>For ponds and lakes sites that are being monitored</u> - the observers can use a canoe to cover the entire pond area, counting and identifying caiman. In cases where pond sites cannot be accessed by a canoe, the monitoring team can walk around the perimeter of the waterbody identifying eye shine and recording the required data. In situations where it is not possible to walk the perimeter of the pond because of thick vegetation, the team can identify three to four places around the waterbody, from where the waterbody is accessible and make observations from these points. .

Here's how you can tell the difference between the Black Caiman and Spectacled Caiman

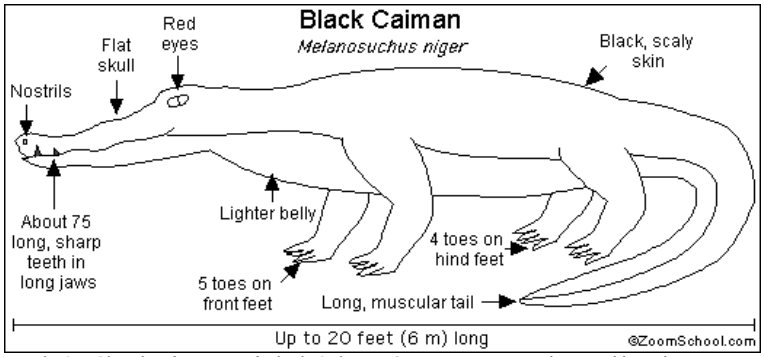


Fig.35 Showing features of Black Caiman. *Source – <u>www.enchannted</u> learning .com*

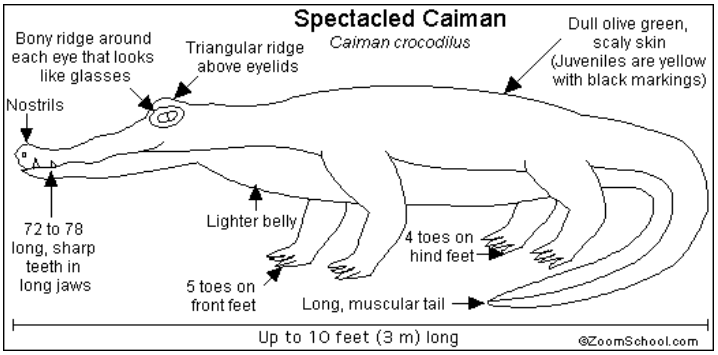


Fig 36. Showing features of Spectacled Caiman. *Source – <u>www.enchannted</u>*

D. Data Analysis for Bird and Wildlife Monitoring

The following are two potential outputs from the bird and wildlife observations.

1. Species list of birds and wildlife for each site.
2. Seasonal calendars and or graphs, using species or general classes. For example the occurrence of the (SPECIES) Capped Heron throughout the year, or the occurrence of (GENERAL CLASS) Herons throughout the year.
3. Distribution data for species throughout the year
4. Bird and wildlife charts can also be combined with other data, e.g. graph bird species and water depth for each month

Month	**M1**2005	**M1**2006	**M2**2005	**M2**2006	**M3**2005	**M3**2006	**M4**2005	**M4**2006
# of Capped Heron	8	7	8	6	5	6	7	8

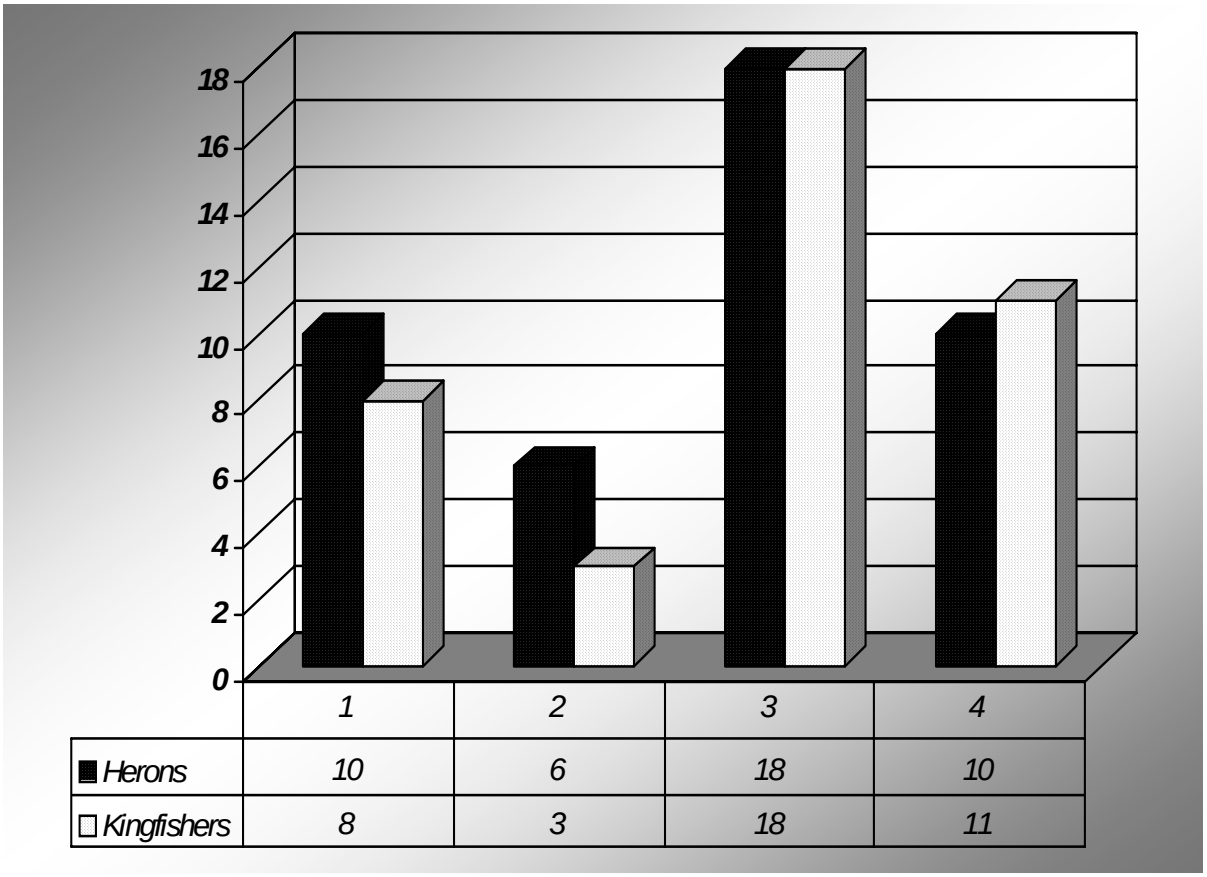
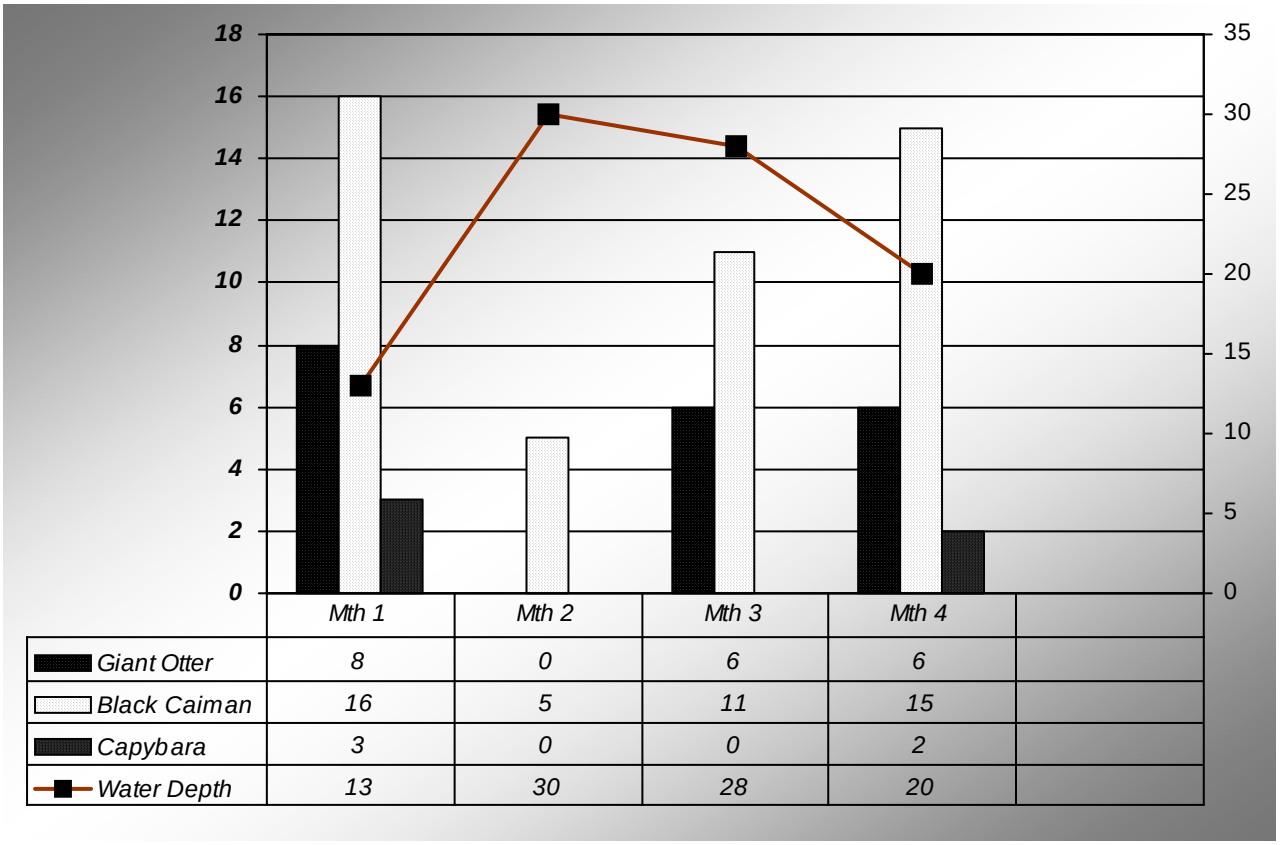


Fig 37 Histogram showing total number of Herons compared with the total number of Kingfishers seen for the 1 Year at Site A with monitoring four times per year (twice in rainy and twice in dry season)



	Mth 1	Mth 2	Mth 3	Mth 4	
Giant Otter	8	0	6	6	
Black Caiman	16	5	11	15	
Capybara	3	0	0	2	
Water Depth	13	30	28	20	

Fig 38 Showing Chart of Frequency of Sightings of the Giant Otter, Black Caiman and Capybara in relation to the depth of the water

E. Monitoring Fish and Wildlife Consumption/Use

Monitoring the use of natural resources is also a component of monitoring that communities can implement if they would like to.
This manual describes one method that can be used by villages to monitor their fish, wildlife, and plant materials that are used for everyday livelihood activities.

i. Monitoring Fish Consumption
The fish type found within the Rupununi Wetlands is extremely diverse. Fish is an important natural resource within this region, as it is the main source of protein for people. With increases in local populations, as well as the influences of external pressures that were not present in the past, there will be increased pressure on the fish populations.
Monitoring the consumption will not only allow for the collection of information on quantity (how much is caught), and species (types caught) – but also, for communities, to be able to document any changes in the availability of this resource over time. Detection of these changes can lead to immediate action within the communities to ensure that the fish resources are used sustainably. Fish consumption monitoring can be implemented by each household monitoring its fish intake. This would involve the recording of all fish brought into the home over a one week period in specific months of the year. This is a suggested schedule for monitoring based on community discussion sessions of this manual:-

This would entail each household filling in a form on fish consumption for one week for each of the highlighted months.
The months highlighted were selected so that the wet and dry seasons can be represented

Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry Season				Rainy Season				Dry Season		Small Rainy Season	
	M			M			M		M		M

twice, and in December - when people go on extended fishing trips for the Christmas season. Within any of the selected months, the week for monitoring of fish consumption should be the same for all households within the community. This monitoring would need one person from within the village to inform all households of which week within the selected month that the monitoring will occur. This person will also be responsible for collecting the completed forms from households and to compile the information for the village.

This information can then be submitted to the village leaders and the village to make decisions with regards to use of the fish resource.
Information that should be collected on the form include: -

a) Name of each type of fish
b) Number of each type of fish
c) Largest size of each type
d) Smallest size of each type
e) Fishing method used
f) Fishing locations
g) Total weight of each type of fish

ii. Monitoring Wildmeat Consumption

Monitoring wildlife consumption, because the frequency of use is much less, can occur much more often. One suggested frequency for monitoring the use of wildmeat in villages is to document every event of use any wildmeat (including birds) throughout the year. This monitoring would not be restricted to certain months, but rather would be continued throughout the year.
Another suggested frequency for monitoring the use of wildmeat in communities is:-

Jan	Feb	Mar	April	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dry Season				Rainy Season				Dry Season			Small Rainy Season
	M			M			M				M

Information that should be collected include:-

a) Type of animal
b) Number of or quantity of
c) Size (adult or young)
d) Method of capture
e) Location caught from

iii. Wood, Leaves and other natural materials

Communities can also monitor the use of wood, leaves and other like material if they choose to. The proposed schedule for monitoring with regards to wood and leaves is for the use to be recorded as each event of harvest per household. Materials that can be monitored include wood materials used for construction, and leaves used for thatching roofs.
Information that should be recorded include: - the type (name) of resource, amount or quantity, method of harvest, and location of harvest.

Hi, it's Manong Carmela, by monitoring our resource use we will be able to have important information for our communities on their resource use and resource use areas. This information in turn would guide planning projects within communities' resource areas.

The information collected can have short, medium and long term implications for our Rupununi home. Initially, the information can be used to guide resource use, but with monitoring changes in pressures can also be documented by communities, thus leading to adaptive planning/management.

In monitoring community resource use, to provide information for decision making, it

is also important that information of the size of the community population be taken into consideration. This is important as it is directly linked to resource use. Most communities already implement such monitoring by recording births, and deaths, as well as the number of persons leaving and entering our villages to live.

I hope we have described clearly how we can go about monitoring our resources in the North Rupununi so than we can make wise decisions for their use for all of us that depend on the Rupununi wetlands and the resources found there for our survival!

Keep reading, the data sheets and reporting formats are included in the remaining pages of this manual!! Good bye!