The North Rupununi Adaptive Management Process (NRAMP) 2008

Darwin Initiative Guyana Partnership

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Iwokrama International Centre for Rain Forest
Conservation and Development
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1. Introduction to NRAMP

1.1 Mission statement

The North Rupununi Adaptive Management Process (NRAMP) is aimed at facilitating effective and appropriate natural resource management to promote and sustain human and ecological health in the face of increasing social and environmental change.

1.2 Healthy wetlands, healthy people

The World Health Organisation (WHO) defines 'health' as "a complete state of physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO Constitution, 1948). In 1986, the Ottawa Charter for Health Promotion added that "the fundamental conditions and resources for health are peace, shelter, education, food, income, a stable ecosystem, sustainable resources, social justice and equity"(WHO, 1986). The effects of changes in the environment, both at the larger scale (e.g. climate change) and at the smaller scale (e.g. land use change) can have fundamental consequences for human health. In a recent report from the Millennium Ecosystem Assessment (MEA/WHO, 2005), the link between human health and ecosystems, particularly the services they provide (which includes provisioning services such as food and fresh water; regulating services such as regulation of floods, drought, and disease; supporting services such as soil formation and nutrient cycling; and cultural services such as spiritual and recreational services) was highlighted. Changes in these ecosystem services can have drastic effects on the health of dependent communities.

Wetland ecosystems (including lakes, rivers, marshes, and coastal regions to a depth of 6 meters at low tide) deliver a wide range of ecosystem services that contribute to human well-being, such as fish, water supply, water purification, climate regulation, flood regulation, coastal protection, recreational opportunities, and, increasingly, tourism (RAMSAR, 1971). At the same time, the degradation and loss of wetlands is more rapid than that of other ecosystems (Millennium Ecosystem Assessment, 2005). Indirect drivers of degradation and loss have been population growth and economic development. The primary direct drivers of degradation and loss include infrastructure development, land conversion, water withdrawal, eutrophication and pollution, overharvesting and overexploitation, and the introduction of invasive alien species. The knock on health threats of these changes in wetland ecosystems include the reduction in fish supply, increased incidence of vector-borne and waterborne diseases, degradation of water supply and quality, increased risk of flooding, excessive nutrient loading in waterbodies and decrease in potential economic income. Growing pressures from multiple direct drivers increase the likelihood of potentially abrupt changes in wetland ecosystems, which can be large in magnitude and difficult, expensive, or impossible to reverse.

The links between environmental change and human health are complex because they are often indirect, displaced in space and time, and dependent on a number of modifying forces. Two routes have been identified for avoiding disease and injury caused by ecosystem disruption: one is to prevent, limit or manage environmental damage; the other way is to make whatever changes will protect individuals and populations from the consequences of ecosystem change. For the latter, two inter-related aspects need to be considered to understand the potential negative health impacts of ecosystem change: the current (and likely future) vulnerability of populations; and their future capacity for adaptation. The forces that place populations at risk (such as poverty and high burdens of disease) in many cases also impair the capacity of these populations to prepare for the future.

It has been well documented that it is the poorest and least powerful people who are most vulnerable to environmental change, access to resources and disease and injury. Indigenous peoples fall into this category, and a recent series on indigenous peoples and health launched by *The Lancet* (see http://www.thelancet.

com/collections/series/indigenous_health) highlights the limited focus to date on these groups of people. Although over 80% of the world's indigenous peoples live in Asia, Latin America, and Africa, little is known about their health status or access to health services. The few studies of particular communities indicate that the health of indigenous peoples is substantially poorer than that of the general population, with disease and mortality rates much higher than the general population (Hsu, 1990; Kestler, 1995; Escobar *et al.*, 2001). Importantly, unlike many western models of health, indigenous peoples' notion of health is often not individual, but one that encompasses the health of the whole community and the health of the ecosystem in which they live (Stephens *et al.*, 2005). As Horton (2006) points out, with the second decade dedicated to the world's indigenous peoples launched at the fifth session of the UN Permanent Forum on Indigenous Issues (UNPFII) in May 2006, now is the time to act for the health of these extremely vulnerable groups.

1.3 The development of the NRAMP

The NRAMP arose out of the Wetlands Project which was funded by the Darwin Initiative and has been operational in Guyana since September 2003. There were two phases to the project: Phase 1 from 2003 to 2006 and Phase 2 from 2006 to 2008. The Project brought together a range of institutions in both Guyana and the United Kingdom, including Royal Holloway University of London, the Wildfowl and Wetlands Trust, the Open University, Iwokrama International Centre, the North Rupununi District Development Board, the University of Guyana, the Guyana Environmental Protection Agency and the Ministry of Education. The Project was managed locally by the Iwokrama Centre (Phase 1) and the University of Guyana (Phase 2) and implemented by the Wetland Team. This team included biologists from Iwokrama and the EPA, lecturers from the University of Guyana, Iwokrama Forest Rangers, and Field Researchers from the North Rupununi communities.

The main objectives of Phase 1 were:

1) to transfer research and management techniques and technology through training of local counterparts;
2) to classify the North Rupununi District habitats utilising eco-hydrogeomorphic criteria; 3) to map the location of different habitat and land use types using remote sensed and GIS data;
4) to identify representative examples of impacted and non-impacted sites for each habitat type;
5) to develop monitoring protocols;
6) to undertake surveys of habitat quality and key species distribution in the selected areas to determine the effects of land use changes;
7) to link the eco-hydrogeomorphological determinants to land use and key species distribution;
8) to develop indicators and management plans for the ecosystems based on this research.

Phase 1 of the Project began in September 2003 and a training workshop took place in January 2004, focusing on a systems approach to monitoring and its techniques. A systems approach focuses on not looking at cause-effect relationships in isolation, but identifying how the structures and processes of a whole system, such as the North Rupununi wetlands, operates, and determining whether the system as a whole is healthy. Following the first phase of training in January 2004, 33 sites were identified for monitoring over the next two and a half years. The training allowed the Wetland Team to commence monitoring of these sites in March 2004. The data collected included features such as weather, water depth, bank vegetation and land use activities, to name a few. Species surveys were also conducted, focusing on birds within the waterbody, caiman, fish, giant river otters and any other incidental observations. After the first twelve months

of monitoring, two sites were dropped after consideration of site representation and logistical difficulties. As such, two years of data has been collected for 31 sites, with monitoring activities concluded in April 2006.

A social component was added to monitoring activities in January 2005 with a preliminary review of local resource use in the fifteen communities of the North Rupununi. These sessions were followed by further community visits, which involved collecting information on a range of wetland related livelihood and social indicators. Social monitoring continued until August 2006.

The results of this first phase highlighted the extremely high biodiversity and complex wetland habitats still intact within the North Rupununi. The findings also showed that people living within the region had intimate knowledge about the wetlands and their resources, and that current human activity within the region was minimal in terms of adversely affecting the wetlands. Discussions over several stakeholder forums identified that management of the wetlands had to be adaptive rather than prescriptive and that a 'process' was required which could be used in any natural resource management situation by a range of stakeholders. It is from this that the NRAMP was first developed.

Further funding was awarded by the Darwin Initiative in 2006 to extend the project until March 2008. The purpose of Phase 2 was to build capacity of stakeholders at both local and national level in implementing the North Rupununi Adaptive Management Process (NRAMP) in ways that are ecologically, socially and financially sustainable. The focus in Phase 2 was to assist the Guyanese partners in the implementation of NRAMP by:

1) significantly expanding the number of trained individuals in biodiversity monitoring and management;
2) developing material for Guyanese university courses and schools to help raise awareness of, and build capacity for, biodiversity conservation (providing the next generation of biodiversity professionals and active conservationists);
3) developing local financially sustainable livelihood schemes, such as eco-tourism, that have a linked objective to the biodiversity monitoring and conservation of key wetland habitats important to the local communities.

The aims of Phase 2 were addressed through the production of several outputs including teacher and student materials for schools, community and environmental officer courses for local communities and various governmental and non-governmental institutions, and a postgraduate course on wetland management for university level. These materials were used to implement extensive training and livelihood development within local communities and institutions. In addition, materials to support on-going livelihood activities, such as ecotourism were produced and include a wildlife tourist guide and tourist maps. A North Rupununi Community website (www.nrwetlands.org.gy) was also developed as a means to communicate the sustainable development, training and conservation and research initiatives in the North Rupununi. A NRAMP Impact Assessment report was also produced to report on the ecological, social, financial and political impact of the NRAMP implementation and the evolving capacity within the Rupununi and Guyana to meet biodiversity obligations. A range of publications and materials from the project can be found on the website.

The second phase of the project, particularly the experiences of training both local communities and members of various institutions, and working with local communities on sustainable livelihood development initiatives, helped to further develop the NRAMP into this document. By the very nature of adaptive management planning, ideas, data and opinions are in constant evolution. To reflect this constant evolution, we hope that the NRAMP documentation will be regularly updated by those who use it.

2. NRAMP principles and approach

2.1 NRAMP principles

2.1.1 Ethics in natural resource management

The two ethical principles proposed below have underpinned the NRAMP in its initial stages. The main themes they consider are ecological sustainability and social justice. Together, they provide the foundation for achieving both a healthy ecology and a healthy society in the North Rupununi. The ethical principles outlined are meant to serve as a start to what is hoped will become a regular and fruitful debate among NRAMP practitioners. These principles should not therefore be considered equivalent to the "10 Commandments" Moses brought down from Mount Sinai, but rather, some guidelines for people to consider and discuss, in the hope that better guidelines are developed which will be appropriate for the ever-changing circumstances in the Rupununi, Guyana, and worldwide.

Some people may wonder why there is a need for explicit consideration of ethical issues within a process focusing on natural resource management. Ethics is about people's values and beliefs. These values and beliefs determine how we exploit natural resources and how the benefits of natural resource exploitation are shared. Is the current level of natural resource exploitation within the Rupununi sustainable? Can we guarantee that future generations will have access to the same levels of resources? Are current levels of resource exploitation fair? Questions such as these are very much about challenging people's existing values and beliefs. Ethics should therefore be at the centre of any natural resource management process.

2.1.1.1 Ecological sustainability

The ethical principle of ecological sustainability is firmly based on balancing the needs of the present population with other species that share the same locality, without compromising the needs of future generations of all species. The guiding principle of ecological sustainability is to balance our immediate needs with those of future generations. People in the Rupununi can currently meet many of their essential needs (such as fish and crops for consumption, materials for building, etc) without having a significant impact on the species that they live with. How can we guarantee that future generations will have access to the same resources and to therefore have a similar standard of living, while at the same time maintaining the same balance with other species? How can we guarantee that even the current generation can have access to the same resources in even the next 10 years?

Many cultures simply exhaust local resources thinking that these can be replaced with resources from elsewhere. For example, once local fish stocks are depleted, maybe people in the Rupununi can replace these with canned tuna and sardines? But even tuna and sardine stocks, once vast resources, are becoming depleted. Another alternative, is to abandon the region in search of resources elsewhere. This is what drove the mass migration of Europeans and Asians to the New World. Just under half of Guyana's population are direct descendants of South Asians who voluntarily left difficult conditions in the hope for access to greater resources such as land. Unfortunately, there are few places in the world that will now happily accepted environmental/economic migrants. The challenge is to therefore maintain a healthy local ecosystem so as to sustain healthy local people, both now and in the future.

In many places it is becoming increasingly difficult to measure the impact one is having on ecosystems and to therefore know whether activities are sustainable or not. Many people living in cities do not know where their food comes from and where their wastes go to. The relatively low economic cost of transporting food and products across the world means that a consumer would find it difficult to discover whether the product he or she has bought was produced sustainably.

The best approach is to therefore strive to rely on local products and services. In that way you can quickly find out whether your practices are ecologically sustainable or not.

What are the practical implications for NRAMP? The process should support local sustainable livelihoods which meet people's essential needs of food and shelter both now and in the future, while at the same time sustaining viable populations of local species. The support of traditional hunting, fishing, and farming is an example. Exploitation of natural resources for economic gain (i.e. that would result in personal income to a group of people who have already met their essential needs of food and shelter) should not place in danger the ability for other people and future generations to meet their essential needs, and the survival of other species. For example, commercial logging of forests within the Rupununi should be evaluated and monitored in order to determine its impact on essential resources and species.

2.1.1.2 Social justice

The ethical principle of social justice is about giving all members of society an equal say in decisions so that these are arrived at in a fair and consensual way. This gives equality of voice between men and women, young and old, poor and rich, different cultures, different colours, abled and disabled, educated and uneducated, different religions, etc. The aim here is to minimize conflict, racism, prejudice, chauvinism, corruption, and injustice.

It is clear to everyone that some major injustices exist in the Rupununi. For too long Amerindians have been considered second-class citizens. Their traditional lands have been taken away from them, first by British ranchers, and now by the State. Most of the land area in the Rupununi is still "state land" which means that local communities have no rights whatsoever to determine how the resources in these areas are exploited. The State had the right to sell exploitation rights to foreign companies and wealthy Guyanese businessmen from the coast, with little or no returns to the original owners of the land.

When some land rights are eventually given to local communities, the area is often not large enough to sustain traditional livelihoods, forcing many individuals, especially youths, to migrate to cities in search of jobs, thus further eroding communities.

Women in the Rupununi have also suffered a great deal. Many are not allowed to speak out and take positions of leadership within communities, regional and national institutions. How many women in the Rupununi are political leaders? How many run businesses? How many play an important role in religious events? The effects of discrimination are not always obvious, but one simple indicator is to look at the amount of money controlled and spent by a man compared to a woman in the same household.

Most importantly, the issue of justice for children should be considered. Every child has a right to basic resources such as food, clean water, shelter, education and time for recreation. The current popular worldview is that those people who are wealthy are so because they have earned it. The truth is that, for most adults, personal wealth is rarely as a result of hard work, but more as a result of being born into a wealthy family. Wealthy families can afford to give their children nutritious food, clean water, safe accommodation, a good education and lots of free time to play. Poor families cannot afford these essential requirements for growing a healthy child. As a result, these children are badly equipped to succeed in society. It is only once all children have received equal treatment, that one will be able to say that one's success is truly a result of one's own hard work.

What is the inevitable outcome of social injustice? Poor health. Unequal distribution of resources undermines the health of everyone. Over 10 million children die each year unnecessarily as a result of insufficient and unbalanced nutrition, and lack of basic health care and sanitation. But the poor are not the only victims of this inequality. An increasing proportion of the population in developed countries is suffering from "diseases

of over consumption": obesity; diabetes; heart failure; and chemically induced cancers (e.g. from smoking or alcohol consumption). So tackling the issue of human health within NRAMP inevitably leads to raising issues of social justice.

There are several practical implications for NRAMP. Decision-making power about managing local resources should be given to those people who actually live in the Rupununi. Communities in the Rupununi have a right to determine how their resources are exploited and who should benefit from the exploitation. They also have a right to determine which services should be provided, such as education and health care, and how they should be run, with the aim of providing free and equitable access to all children in the region. Within the communities themselves, women should have the same rights as men to participate in decision-making and to determine financial expenditure. This basically means that any NRAMP initiative should be led by the communities and the benefits should be equally distributed, with special priority given to supporting children.

2.1.2 Ethics in practice

How do we relate these ethical principles to the everyday practises of stakeholders involved in either directly managing natural resources in the Rupununi, such as community members, or indirectly affecting their management, such as government officials? NRAMP is not a prescriptive management plan. NRAMP is not going to tell people what to do on the ground ie, natural resource extraction quotas. What we are proposing is a process that will allow people themselves to discover their own solutions to their own problems. What we have to demonstrate is that the process can actually work for them. What we should propose as facilitators is that any outcome of the participatory process does not fall out of the principles outlined above.

An issue that the above resources bring up is scale both in terms of time and space. Individual community members are mostly concerned with immediate issues within their particular locality. Our challenge is to demonstrate that local decisions could have long term and wide ranging impacts that will affect a whole community. The same thing goes for decision makers at national level. National laws and administrative structures will have impacts at regional and local level. So we are dealing with stakeholders interested in different spatio-temporal and organisational scales.

What the first Darwin Project has started to do is provide a rich database of information on which people can base their decisions. The important aspect here is that decision making builds on "facts" rather than just opinions, beliefs, hunches etc. The challenge is to provide information in a format that is useful to the end user. How can we develop indicators of ecological sustainability and social justice? How can these indicators be communicated in a clear away to a range of decision-makers?

Information is power. Many community members are powerless because they do not have the information to confront powerful decision makers. How can we empower them with information? How can we let powerful decision-makers hear the voice of community members? Below are distinct ways of tackling the above issues through participation, holistic and adaptive management, the use of evidence, and being practical in the face of the huge difficulties of working in the Rupununi and Guyana in general.

2.2 NRAMP approaches

2.2.1 NRAMP approach to natural resource management

There are a wide range of approaches to natural resource management. Some approaches delegate decision-making responsibility to experts, focus on particular disciplines (such as hydrology or economics), or require significant levels of funding to implement. Other approaches are sometimes termed 'bottom-up', where the agendas for natural resource management are set and driven by local communities. In NRAMP, we recognise

that natural resource management is a highly complex activity which needs to consider issues of human capacity, the interdisciplinary nature of natural resource management and the wider socio-political and ethical environment within which it operates.

A significant limiting factor with both expert and community led approaches is human capacity. Natural resource management involves a range of skills, including ecological knowledge, political awareness, interpersonal abilities, information management and financial management to name a few. These require basic levels of literacy and numeracy, as well as the time and energy that such a complex activity needs. However, in many developing countries, such as Guyana, these basic requirements are usually lacking as a result of poor education, low levels of health care and lack of infrastructure. It is therefore recognised that there are a limited number of people that have the capacity to facilitate the NRAMP approach. So rather than classifying the approach as institutionally or community led, a more suitable label for NRAMP could be 'champion-led'.

Another distinctive feature of the NRAMP approach is its 'inclusivity'. When approaches are institutionally- or community-led, there is an automatic assumption of 'exclusivity'. In other words, a particular group develops exclusive rights to decision-making within the process. For institutionally-led approaches, this usually implies that experts within the institutions take control while for community-led approaches, community leaders often drive decision-making. The champion-led approach seeks to involve all parties in the decision-making process, with the champions taking on a neutral role as facilitators.

The above general introduction leads to five principles for explicit consideration within the NRAMP approach: adaptive; participative; holistic; evidence-based; and practical. These are outlined in more detail below.

2.2.1.1 Adaptive

In managing natural resources, we are clearly dealing with a highly complex situation. This situation can be described as a "wicked problem". A wicked problem is something that manifests itself only as you try to engage and change it, and in doing so, the problem in turn changes; there is no definite solution that people could aim at; no case history to draw upon; no right or wrong approach to take which would make everybody equally happy; and there is no way to anticipate the consequences of people's actions or environmental change. The best way to tackle a wicked problem is to constantly learn about the changing situation and adapt accordingly.

The issues that communities face in the North Rupununi are mostly related to the resources they extract from the wetlands, or the unwanted impacts of living so near to wetlands (such as malarial infections of epidemic proportions). For example, the onset and intensity of the seasons vary significantly from year to year, resulting in highly unpredictable abundance and distribution of key resources such as fish. Additional complications arise from the range of stakeholders, with differing roles and objectives, involved in the management of these natural resources. These related dilemmas, as with other types of "wicked problems", are characterised by continual change. Unlike simple problem-solving activities where the problem is well-defined and unchanging, managing North Rupununi natural resource dilemmas involves continual monitoring, learning and negotiation amongst the range of interested and affected parties.

A central aspect of the NRAMP process therefore is its adaptiveness. We believe that management plans within such contexts cannot be static instructions, but ought to change with changing circumstances. As a principal aim of our management process is to improve a problematic situation, we expect things to change (hopefully for the better) as the process is implemented. This automatically implies that we have to set goals according to stakeholder aspirations, collect background information to help set a baseline to determine

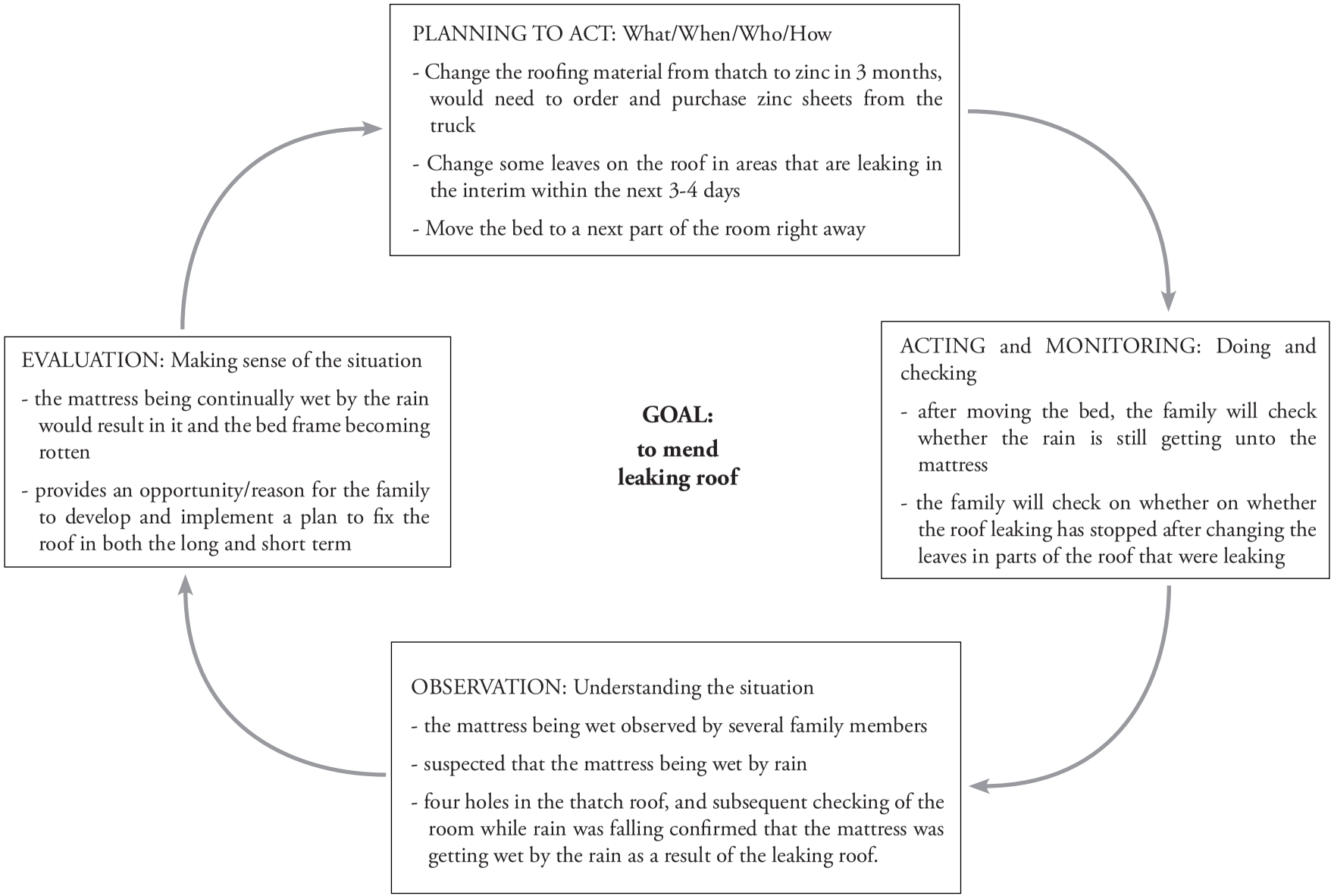
Box 2.1 Roof leaking example of the learning cycle

One day a family while having dinner starts talking about how things are at home and at work. The youngest brother mentions that he observed that the mattress on the bed in the front room was wet last evening. His mother, elder brother and younger sister said that they had made that same observation several times before. So together they started to explore reasons why the bed would be wet. The first possible reason suggested by the eldest brother was that it could be that the bed was wet because of the baby urinating on the mattress. However, mother quickly reminded everyone that the baby was visiting their grandparents with their father yesterday. With that being ruled out, the family continued to think about why the mattress would be wet. Just as the youngest brother was going to ask whether anyone accidentally or deliberately threw water on the mattress, their father asked the youngest brother what time he noticed the mattress being wet. The youngest brother said that it was late in the afternoon that he noticed this at around 6pm. Their father then reminded everyone that rain had fallen that afternoon, and finished just around the time the youngest brother observed the mattress being wet. The family then went to check the room to see whether the rain could have been the reason why the mattress had gotten wet. They observed a few holes in the thatched roof which could be the reason why the mattress had gotten wet. But they were not completely sure, so the family made a decision that they would check the room when rain fell the next time, so that they would be completely sure. It just so happened, the very next morning rain fell, so the father, mother and youngest brother checked to see what was happening. They observed that rain was falling on the mattress at four different places. Just after that observation, the family sat down again to discuss and evaluate this situation.

The father said that they needed to do something before the mattress and the bed frame started rotting because of being constantly wet by the rain. The mother said that this was somewhat of a good occurrence because the family had been planning to change the roofing a long time now, but nothing had happened to date. So after the family thought and voiced their different ideas on the good things and bad things of the situation, they started to plan how they would manage this situation.

The family planned that they needed to change the roofing and roofing materials from thatch to zinc, but that was their long term plan and would take about 3 months for them to source the materials and to be ready to change the roof. In the meantime the family planned to move the bed from that corner of the room and put it into another location in the room, while the family would take 2-3 days to source some new kokerite leaves, to re-thatch the roof in that room and any other places that might be leaking. The family also said that they would have to continue checking on the rooms and the roof of the house, so that they would readily observe if any other areas were leaking.

The learning cycle is a process that we use in our everyday life, in the situations we have to handle. The NRAMP just streamlines this approach, in a manner that it can be clearly understood and appreciated by all levels of stakeholders.


PLANNING TO ACT: What/When/Who/How
- Change the roofing material from thatch to zinc in 3 months, would need to order and purchase zinc sheets from the truck
- Change some leaves on the roof in areas that are leaking in the interim within the next 3-4 days
- Move the bed to a next part of the room right away
ACTING and MONITORING: Doing and checking
- after moving the bed, the family will check whether the rain is still getting unto the mattress
- the family will check on whether on whether the roof leaking has stopped after changing the leaves in parts of the roof that were leaking
OBSERVATION: Understanding the situation
- the mattress being wet observed by several family members
- suspected that the mattress being wet by rain
- four holes in the thatch roof, and subsequent checking of the room while rain was falling confirmed that the mattress was getting wet by the rain as a result of the leaking roof.
EVALUATION: Making sense of the situation
- the mattress being continually wet by the rain would result in it and the bed frame becoming rotten
- provides an opportunity/reason for the family to develop and implement a plan to fix the roof in both the long and short term
GOAL:
to mend
leaking roof

Box 2.2 Feeding a family for one month example of the learning cycle

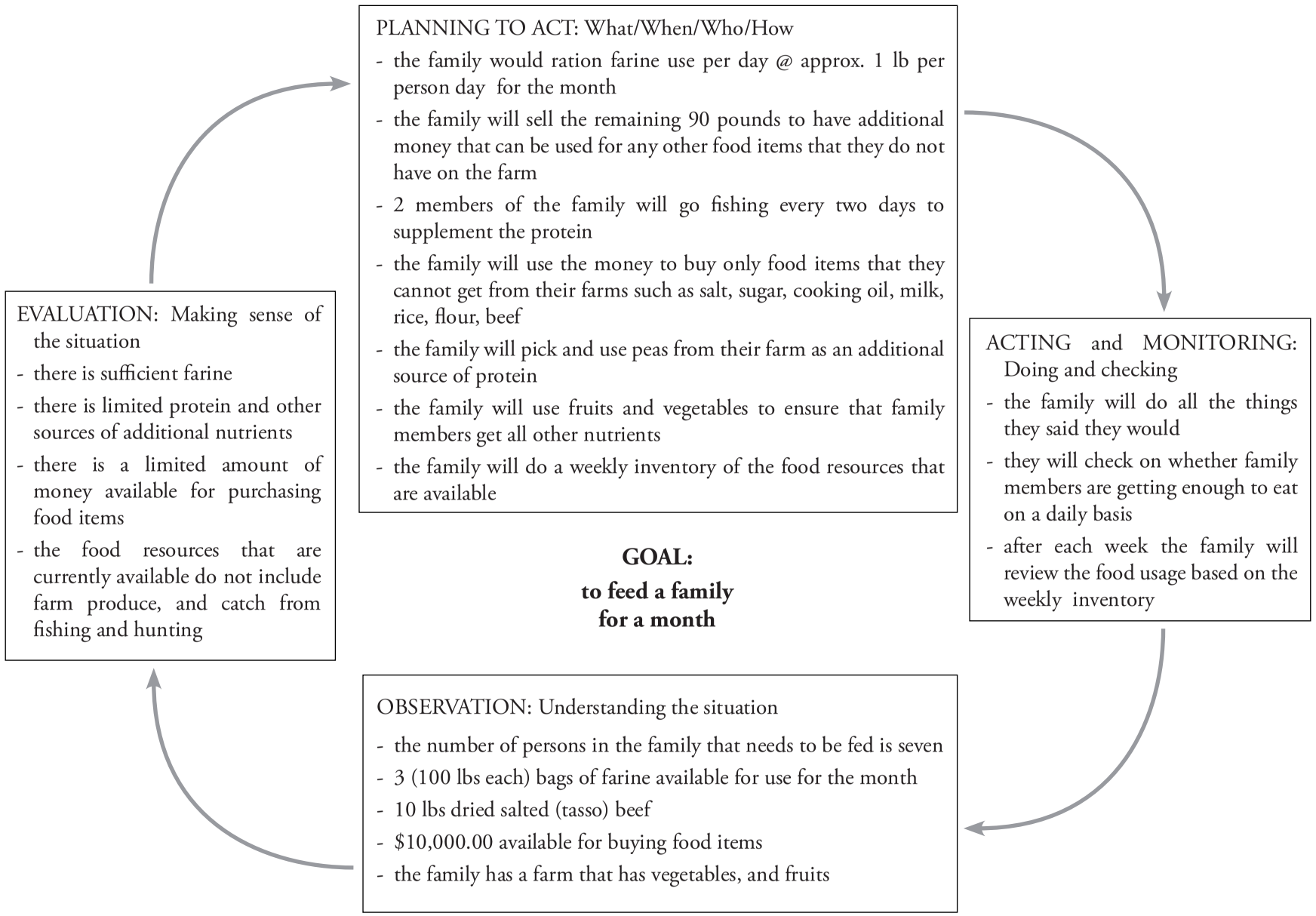
A family sat together to plan their food use for a month. They knew their goal was to ensure that all members had enough food to eat for the entire month. They knew they had to properly manage the food resources that they had to ensure that it kept them fed for the entire month. The first thing that they did was to make an assessment of the food resources that were available to them for the month, and how many persons would need to be fed. Once this was done the family then evaluated their situation in terms of the strong and potentially weak aspects of the food resources they have available to them. Based on their evaluation they then made plans on how they would use the resources they had available and actions or things that they would do to ensure that the strong aspects remain strong and to strengthen the weak points of the resources they had available to them. After the developed their plans, they then set out to do the things they planned to do.

whether the goals are achievable, evaluate this information according to the goals, plan future actions in order to support positive change or reverse negative change, put into action the agreed plans by allocating responsibilities and resources, observe the changes that are taking place, and evaluate whether these changes are in accordance with the agreed plans. This sequence contains the five steps of goal setting, observation, evaluation, planning and implementation (see *NRAMP Methodology* section), which can be repeated as many times as is necessary. Iteration between these steps can be described as a *learning cycle*. In other words, in order to improve the situation, we have to be able to learn about the changing circumstances and even learn from our own mistakes. Boxes 2.1 and 2.2 give examples of the learning cycle.

Recording the process of learning is essential so that progress can be measured with a degree of accuracy and mistakes are not repeated over and over again as the inevitable changeover in facilitators and decision-makers occurs. The section on the NRAMP methodology will go into much greater detail on specific techniques and tools that we have used to support this learning process.

2.2.1.2 Participative

A key element of the NRAMP process is participation. There are three main ways one can develop and implement a natural resource management process. The first approach is to decide for stakeholders. So-called experts are brought in to write a plan which tells stakeholders what to do. A major problem with this approach is that most experts are not "know all geniuses" so their understanding of a situation will always be limited, especially if they haven't spent a long time on site to become familiar with the local and national culture, and the local ecology. Most expert-led plans are therefore limited in their application since they usually focus on the expert's area of specialisation and rarely take into account local details. These experts often carry out a token consultation exercise with no guarantee that stakeholder views are taken into account. There is also the additional problem that as a result of Guyana's limited human resources, most of these experts are foreign. Jeanette Forte in her book "About Guyanese Amerindians" (1995) states that "Guyana has become a kind of academic mecca in natural science fields, because of the territory's extraordinary biodiversity and variety of intact ecosystems, but also in the study of indigenous peoples" (p.2). Sometimes the driving force behind what the foreign expert does is questionable, especially when often there are institutional and personal pressures to publish research, increase research funding, and further reputation through things such as conference presentations. In many cases, all that is left for the host country is an end-of-project report which lies gathering dust on a shelf.


PLANNING TO ACT: What/When/Who/How
- the family would ration farine use per day @ approx. 1 lb per person day for the month
- the family will sell the remaining 90 pounds to have additional money that can be used for any other food items that they do not have on the farm
- 2 members of the family will go fishing every two days to supplement the protein
- the family will use the money to buy only food items that they cannot get from their farms such as salt, sugar, cooking oil, milk, rice, flour, beef
- the family will pick and use peas from their farm as an additional source of protein
- the family will use fruits and vegetables to ensure that family members get all other nutrients
- the family will do a weekly inventory of the food resources that are available
ACTING and MONITORING: Doing and checking
- the family will do all the things they said they would
- they will check on whether family members are getting enough to eat on a daily basis
- after each week the family will review the food usage based on the weekly inventory
OBSERVATION: Understanding the situation
- the number of persons in the family that needs to be fed is seven
- 3 (100 lbs each) bags of farine available for use for the month
- 10 lbs dried salted (tasso) beef
- $10,000.00 available for buying food items
- the family has a farm that has vegetables, and fruits
EVALUATION: Making sense of the situation
- there is sufficient farine
- there is limited protein and other sources of additional nutrients
- there is a limited amount of money available for purchasing food items
- the food resources that are currently available do not include farm produce, and catch from fishing and hunting
GOAL:
to feed a family
for a month

The second approach is for experts to decide with stakeholders. This is where the experts work with stakeholders every step of the way to develop a plan that ought in theory represent a wide range of views. This approach is often a compromise between the limited time and resources available to carry out the project and the wish to engage and build capacity within stakeholders. This approach is also appropriate only if the experts are residents within the area of interest and have a guaranteed long-term commitment to it.

The third approach is to facilitate and empower stakeholders to make their own plans. Here, the experts' opinions are not included in the plan at all, and instead the experts become faciliators, or 'champions' to focus on building stakeholder capacity to develop the plan. This third approach is the ultimate aim of NRAMP. With the shift towards more democratic decision-making, the days of top-down dictatorial control are increasingly no longer appropriate. Institutions and experts that promote centralised control are finding it difficult to appropriate the necessary resources and command the required respect to implement major regional plans.

On the other hand, the issue of respect is actually a major problem, where many stakeholders and individuals within stakeholder groups actually verge on the anarchic; doing as they wish and sometimes even breaking institutional and national regulations and laws. It is not rare to hear about incompetence, corruption and the embezzlement of funds. Thus, the 'champion-led' focus on participation is a two edged sword -- convincing some stakeholders to abandon their toothless rhetoric of control, while at the same time trying to coordinate the actions of stakeholders towards constructive and selfless contributions.

There is also a deeper questioning of the term "participation". Apparently open events such as stakeholder fora often result in the most powerful stakeholders pushing their agenda, while the weaker groups, usually the very individuals that depend on the natural resources for their livelihoods and survival, are not able to contribute to the decision-making process. The NRAMP process makes a concerted attempt to engage the most marginalised and promotes the explicit identification of distinct categories of stakeholders. For example, prioritising those whose essential needs (such as health, nutrition and shelter) have not been met and clarifying who will benefit or lose from any decision.

Unfortunately, the major drawback of stakeholder capacity building and empowerment is that concrete outputs take time to be produced in the initial phases of plan implementation. The advantage though is that eventually the outputs can be self-sustaining through local champions, without the need for external expertise and funding.

2.2.1.3 Holistic

Natural resource management in developing countries is often associated with particular special interest areas, such as biodiversity conservation or poverty alleviation. This usually results from the particular funding agency and its interests, for example, conservation NGOs focus on biodiversity, while development agencies focus on poverty alleviation. A major danger in being labelled a special interest project is the automatic relegation of the project to a limited remit. For example, there is often a justified accusation of eco-fascism within many Western conservation NGOs and agencies concerned solely with the welfare of rare animal and plant species. Many of these organisations have in the past promoted the exclusion of local people from areas of high biodiversity importance. Conservation areas have become militarised zones with rangers granted powers of punishment (sometimes including the right to shoot and kill) and locals criminalised as traditional resource extraction practices become labelled as "poaching".

It is also recognised that powerful NGOs and agencies selectively identify environmental problems to further strengthen their position in the country. It is easy to blame local people for biodiversity loss and environmental degradation thus justifying the shift in control for local natural resource management away from local

people to these NGOs and agencies. We want to make it absolutely clear here that the NRAMP approach firmly supports the fact that local and traditional natural resource users are an integral component of regional ecosystems. Traditional communities have often been able to arrive at a relatively balanced relationship with their local environment and NRAMP aims to build on these experiences and support the maintenance of traditional and sustainable forms of exploitation.

Because local communities depend on natural resources for their survival, they will be the first to feel the effects of changes in natural resource management practices. They will also ultimately determine the success or failure of any natural resource managament approach. The aim of NRAMP is therefore to break out of the constraining focus on special interest categories, such as biodiversity conservation, and take a holistic approach to the management of the North Rupununi wetlands, including social, economic, political and health aspects.

For communities that rely so heavily on local natural resource exploitation, an ecological crisis is also a social, political and economic crisis. The introductory section 'Healthy wetlands, healthy people' outlines the particular holistic theme of NRAMP.

2.2.1.4 Evidence based

NRAMP emphasises that decision-making in natural resource management should be based on concrete facts. If you can't measure something, then you can't manage it. Thus, the process has a strong element of ecological and social monitoring which ought to provide the necessary evidence for supporting the process deliberations and recommendations. We would like to stress here that although monitoring is time-consuming and resource intensive, without reliable information the process will soon lose credibility and stakeholders will find it difficult to make decisions in the absence of factual evidence. Decisions in the absence of factual information may even turn out to be extremely damaging.

In cases where there is an absence of information, then we propose the adoption of the "precautionary principle". Basically this means that one would follow the axiom "if in doubt, do without". Thus potentially damaging action should be avoided until more is known about the situation.

NRAMP has tried to balance the need for a particular item of information and the resources required to collect it. Significant effort must be used to identify appropriate types of information which can be collected at a low-cost and with limited training. For example, biological indicators are excellent sources of information since local people are already familiar with local species and observation often requires just good eyesight and a pen and paper!

Once the information has been collected, a fundamental component of evidence based decision-making is the creation of an information system. This does not necessarily mean that it has to be computer-based. For an information system to be of use in supporting decision-making, the information must be easily compiled, provided in a format that is easy to understand and access, is straightforward to update, and any analysis which identifies cause and effect explained in clear and transparent terms. For example, if the information shows that fish populations are being exploited unsustainably, stakeholders must be able to clearly see which data supports this evidence and which criteria has been used to label the exploitation as unsustainable. The ability to focus on an appropriate scale to inform practical decision-making is also important. Data and analysis about a whole region will be of no use if problems emerge concerning a particular water body.

Fundamentally, the information system must be distributed as far and wide as possible, especially to those communities that depend on the North Rupununi wetlands for their livelihoods. An excellent example of an easily accessible "information system" is the process for developing and distributing the Darwin Initiative Bulletin, a simple newspaper which is printed regularly and distributed to all communities and stakeholders.

Thus, the role of the NRAMP champion also involves facilitating the collection, storage, analysis and dissemination of information on the NRAMP process. The North Rupununi Context section summarises, for example, key information that has been collected by NRAMP champions to date.

2.2.1.5 Practical

Although the management process has been separated into four phases of goal-setting, planning, acting, observing, and evaluating (see section on *NRAMP Methodology*), so as to facilitate a straightforward understanding of the process, this division, in practice, is often artificial. This is especially the case when the unfamiliar process is introduced within a new situation such as the one in which Darwin UK team members found themselves in during the early stages of the project.

Stakeholders unfamiliar with adaptive management planning have a tendency to instinctively mix observation, evaluation, planning and action, and sometimes naturally omit certain stages. Communication among stakeholders is also generally unstructured and informal. The type of behaviour characteristic of stakeholders is also dependent on existing capacities, resources and interests. A significant challenge is therefore to build capacity, channel resources, and promote interest for an efficient, effective and ethical implementation of NRAMP. Thus much of the initial effort has to be extended in the practical tasks of building basic capacity among stakeholders (such as numeracy, literacy, ICT and time management skills), making sure that resources are not channelled to meet other aims (which in the conditions typical of developing countries, diversion of resources to other seemingly more important tasks are a common occurrence), and trying to generate long-term enthusiasm and support for a process which does not promise immediate financial returns and is currently entirely dependent on donor funding.

One must remember that NRAMP is essentially an output of the individuals participating in the process. There is recognition that stakeholders are under significant pressures: the pay is low, living and working conditions are difficult, and debilitating illnesses such as malaria are frequent. Thus expectations have to be adjusted accordingly and a certain element of flexibility and practicality has to be built into the process.

There is also an understanding that it is easier to be incompetent, lazy and corrupt if one hides behind the anonymous veil of a stakeholder group or institution. It is much more difficult to hide if responsibilities are clearly attributed to you as an individual. Some individuals also feel powerless by the constraints set upon them by their stakeholder group. Thus a fundamental aspect of the NRAMP practical approach has been to empower competent individuals to push through positive change.

In conclusion to this conceptual section, the NRAMP methodology, outlined later in this document, focuses on individuals taking action to improve the situation. At the end of the day, NRAMP is not worth the paper it is written on if we are not able to create a concerted group of determined champions willing to work for the benefit of the human and ecological communities in the North Rupununi, for current and future generations.

3. North Rupununi context

3.1 Geography and ecology

3.1.1 Physical geography

The North Rupununi District in south-west Guyana (04º N 05', 59º W 02') is a mix of savanna, forest and wetland ecosystems (Eden, 1964, 1974) (Figure 3.1). The region straddles the watershed divide between the Amazonian basin and the Essequibo River catchment, the largest drainage basin of the Guiana Shield (Figure 3.2). The area is dominated by three large rivers: the Rupununi, the Takatu, and its tributary, the Ireng. In this area the three rivers pass within approximately 30 km of each other, separated by savanna, criss-crossed by a network of small rivers, creeks and lakes. The Rupununi River drains the central and eastern parts of the savannas, and flows east into the Essequibo. The Takatu and Ireng Rivers drain the western portion of the savannas and flow west into what is eventually the Amazon via the Rio Branco and Rio Negro.

The geology of the Iwokrama and North Rupununi region is complex due to its age. Early plutonic and volcanic rock formation, regional metamorphism, rifting, uplifting, and oscillating periods of sedimentary deposition and erosion have shaped the area into a patchwork landscape of varying geological characteristics. These processes have fundamentally influenced topography, soils, water flow, as well as the potential for commercial activities such as mining, agriculture and timber production (Iwokrama International Centre, n.d.).

Geological attributes contribute significantly towards soil profile and structure. This will have a great role in determining what vegetation is dominant and where they would be found in the Rupununi. Soil profile takes into account several factors such as decaying matter, which determines how rich the soil will be in terms of nutrients, and secondly the type of soil composition (i.e. sand, silt or clay) which has a role to play in the soil's ability to absorb and also retain water. The soils of the savanna differ from that of the rainforest region of the Rupununi in that they show low mineral/nutrient retention and water storage. Flora (plants) that are found in the North Rupununi are therefore specifically adapted for surviving in these conditions (See section on *Flora and Fauna*).

The North Rupununi Wetlands has a high habitat diversity including white, black, and clear water streams, foothill and mountain streams, dissected river systems and ox-bow lake formations. These wetlands are dominated by the Rupununi, Rewa, and Essequibo Rivers, and include over 750 lakes, ponds and inlets covering approximately 22,000 ha. The hydrology of the area is directly influenced by the Rupununi water catchments, Siparuni Water Catchments and the Essequibo Water Catchments. However, it is the Rupununi River catchment that is mostly responsible for the North Rupununi's unique transformation during the wet season (Figure 3.3).

Approximately 8,000 km^2 of the North Rupununi savannas form a seasonally flooded plain during the wet season (the site of the legendary lake of El Dorado), rimmed on the north-west by the Pakaraima mountains, in the north by the Iwokrama mountains and in the south by the Kanuku mountains, allowing the Amazonian and Guiana Shield waters to mix, and effectively creating a water bridge between the two basins. The principal rainy season is from May to September with an average rainfall of 1780 mm, but with substantial year to year variation (Hawkes and Wall, 1993). There is a short rainy season during late December early January. The total annual rainfall within the Iwokrama Forest varies from 1,400 – 3,000 mm of which 50 to 70% falls during the main wet season (Iwokrama International Centre, n.d.).

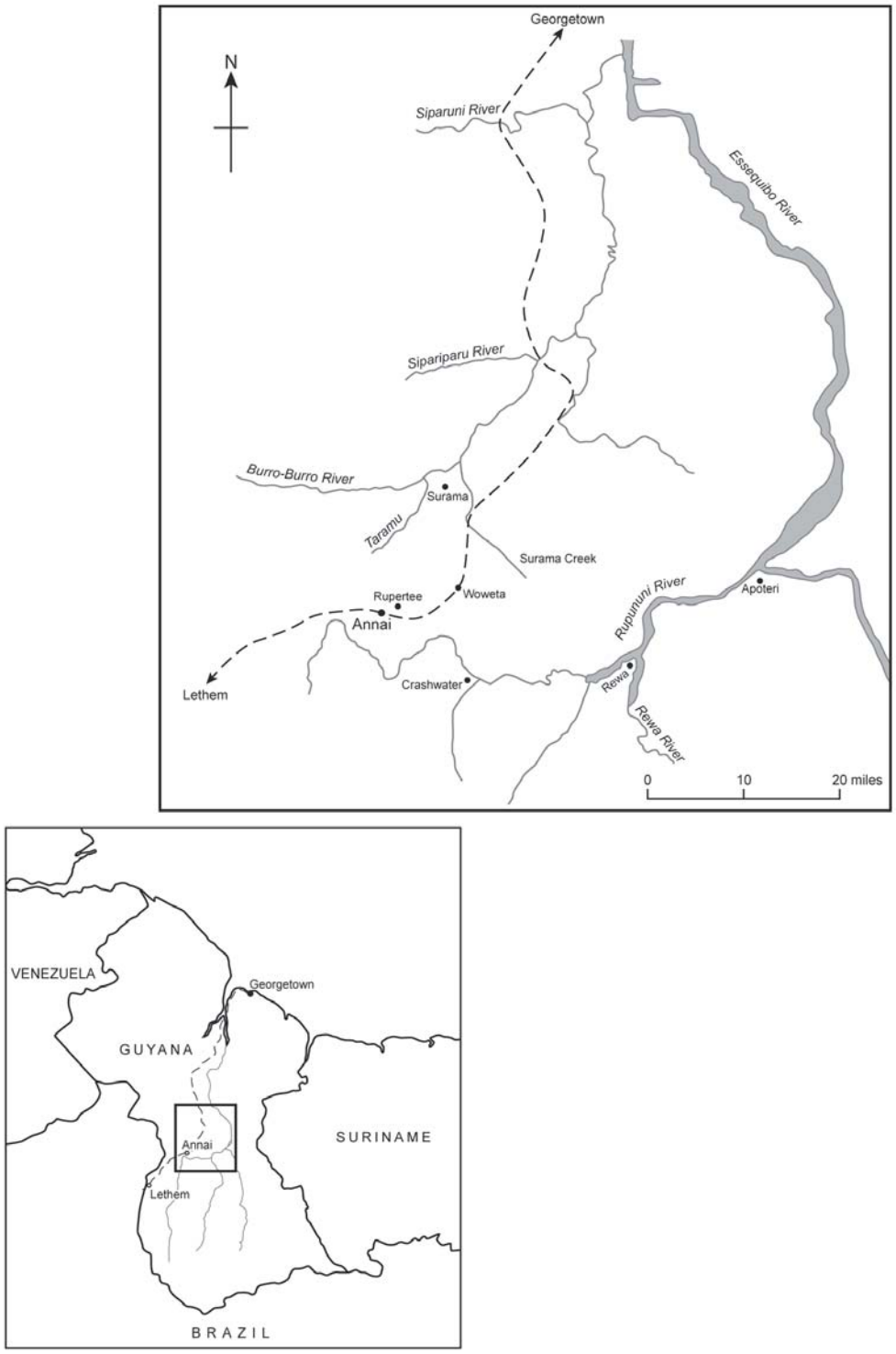


Figure 3.1 Map of North Rupununi District, Guyana

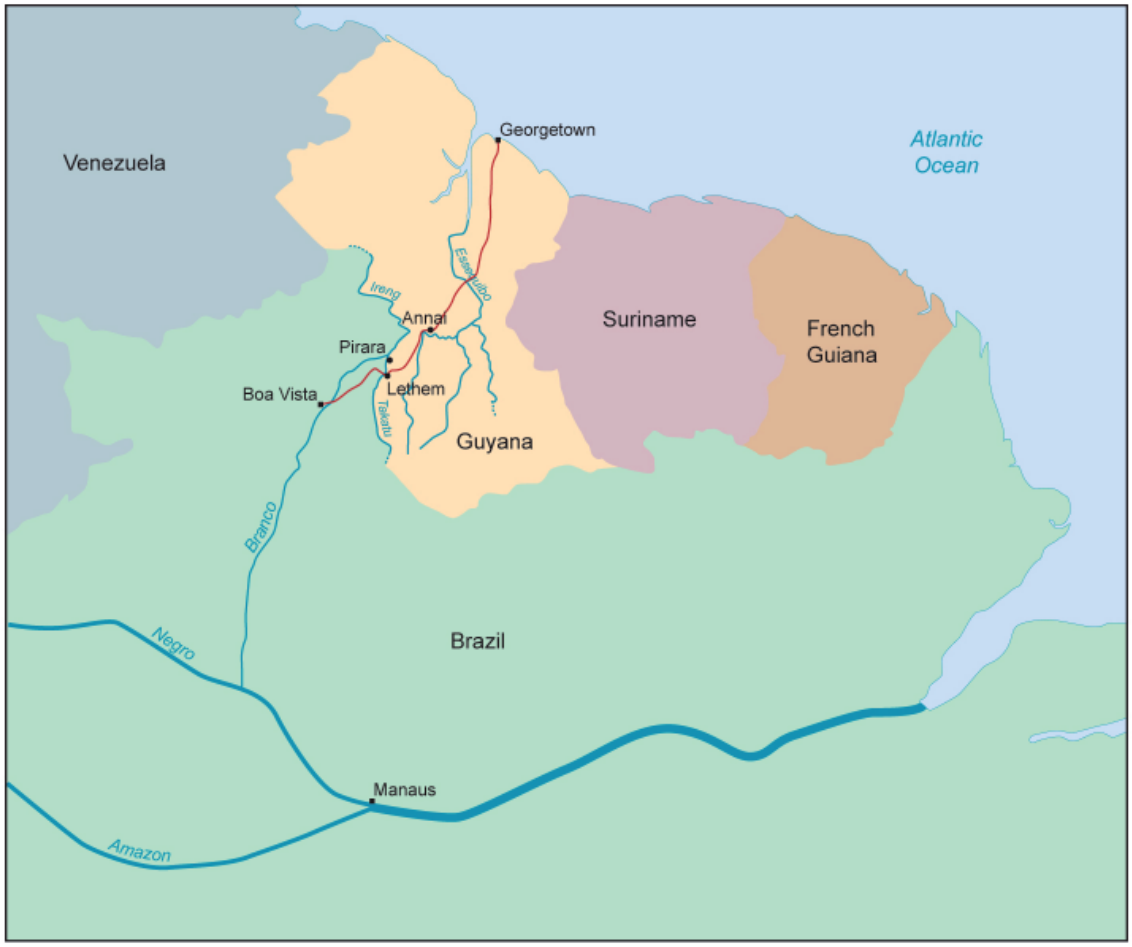


Figure 3.2 Map showing the drainage basin of the Guiana Shield

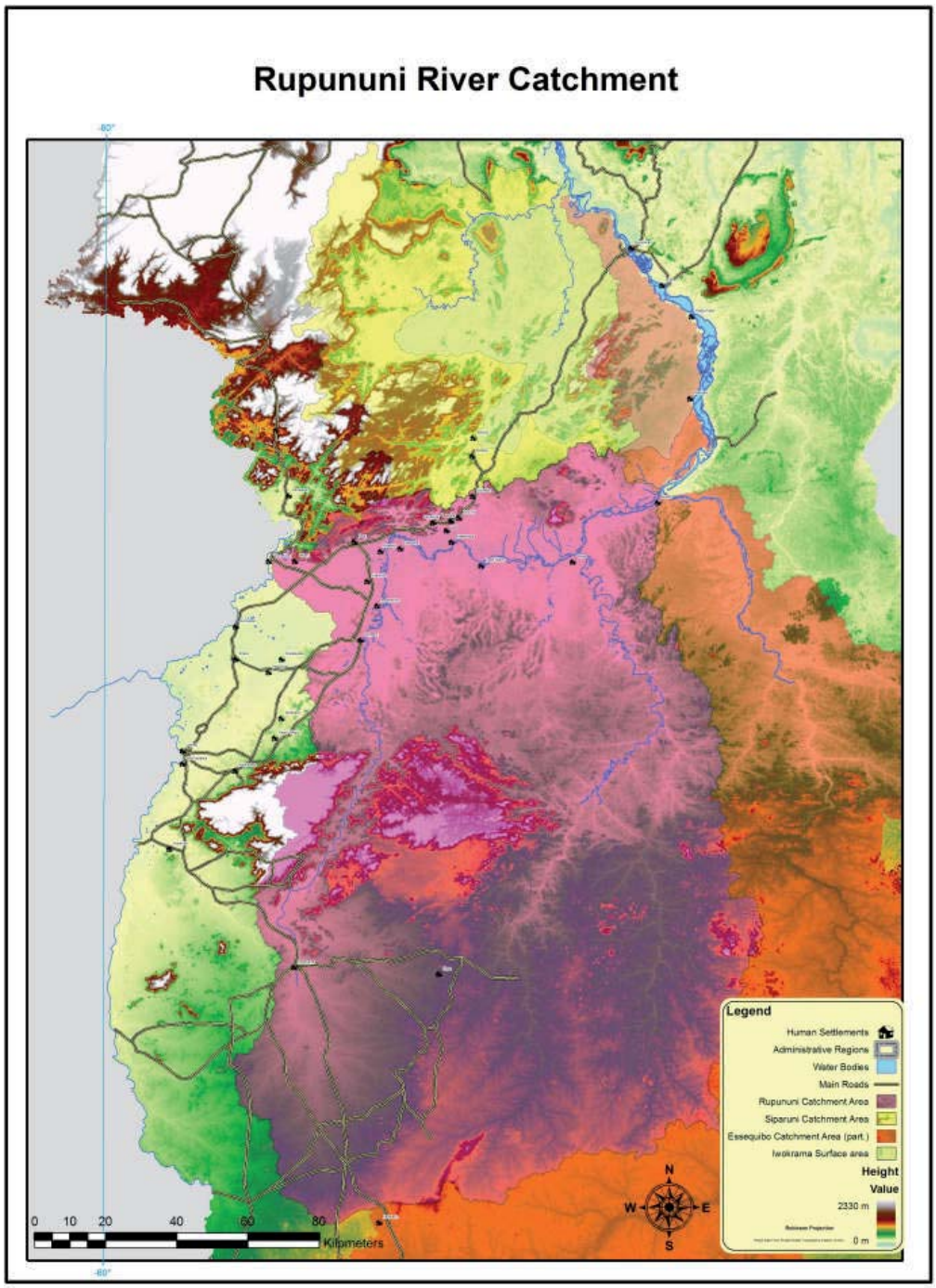


Figure 3.3 Map of the Rupununi River catchment

3.1.2 Flora and Fauna

The North Rupununi is made up of a range of rainforest, savanna and wetland ecosystems which in turn provide a unique and diverse selection of habitats for a rich biodiversity. It has been argued that the seasonal water bridge between the Amazonian and Guiana Shield basins represent a link for species and biodiversity, and is thus a key site for species migration, as well as providing an abundance of food, breeding grounds and diverse habitats. Fishes, turtles and many native birds feed, breed and live in the wetlands all year round. At the same time, many species of migratory birds rely on the wetlands as feeding and breeding grounds. Flooding of these wetlands provides the opportunity of migration for fishes and other species of fauna that would have been otherwise isolated for a time of the year. Similarly, plant species are assisted by seasonal flooding by permitting seed dispersal.

Generally speaking, forest ecosystems support a higher abundance of plants and animals as compared to the savanna ecosystem. There has been over 1500 species documented in the Iwokrama Rainforest (Iwokrama International Centre, 2007). The forested region of the North Rupununi area is generally mixed forest with no particular species dominance. These vary from tropical moist forest, tropical dry forest and at higher altitudes (on mountains and hills), tropical montane forests. These forests include important non-timber product species such as Crabwood (*Carapa guianensis*) which is well known for the oil that is produced from its seeds used for medicinal and industrial purposes. Some common timber species include Wallaba (*Eperua* spp.), Mora (*Mora excelsa*), Silverballi (*Ocotea* spp.), Bullet Wood (*Manilkara bidentata*) and Greenheart (*Chlorocardium rodiei*). Kokrite (*Attalea regia*) and Ite Palm or Tibisiri (*Mauritia flexuosa*) are also prevalent and serve as thatching materials for the Amerindian communities. Small scale clearing of forested areas for subsistence farming through shifting cultivation methods has been the culture of the Amerindians for many years and is still undertaken.

Forested areas gradually give way to extensive savannas. The savanna is a rolling grassland scattered with shrubs and isolated trees. Unlike the soils found in the forested areas, soils in the savannas are generally nutrient poor. Plants that are prevalent here are those that are specially adapted for dry/drought conditions. They may have long tap roots which will enable them to reach the deep water table, drop their leaves in the dry season to avoid evapotranspiration and/or have underground storage organs to conserve water. Ranching has historically been the dominant human activity in the savannas, with the wide use of fire as a management tool, although in recent years ranching has subsided.

With regard specifically to the fauna (animals) of the North Rupununi, it has be estimated that this region supports populations of over 65% of the species of wildlife found in Guyana (Iwokrama and NRDDB, 1998) and it is a known fact that Amerindian communities have coexisted with such wildlife for thousands of years (Forte, 1996). The North Rupununi is home to many species of endangered animals and including those that have come to be known as the 'Giants of El Dorado'. These include the Harpy Eagle (*Harpia harpyja*), Capybara (*Hydrochaeris hydrochaeris*), Jaguar (*Panthera oncca*) and Giant Anteater (*Myrmecophaga tridactyla*). Without a doubt, species richness for insects, amphibian and reptiles will show a similarly diverse range. The Rupununi, Rewa, and Essequibo River systems are home to over 400 species of fish, including the Arapaima (*Arapaima gigas*), the world's largest freshwater fish. Interestingly, comparable wetlands in South America such as the Varzéa of Mamiraua and the Pantanal wetlands, indicate records of only 400 and 200 species of fish respectively. In addition there are healthy populations of internationally endangered species such as the Giant River Turtle (*Podocnemis expansa*), Black Caiman (*Melanosuchus niger*), and Giant Otters (*Pteronura brasiliensis*).

Overall, it is important to recognize and appreciate the functions of the many unique ecosystems that are part of the North Rupununi both individually and as one large interconnected system, which is ultimately responsible for the health and productivity of all the biodiversity found within it.

3.2 The People

3.2.1 Introduction to the people

The North Rupununi Wetland catchment is the traditional home of the Makushi people. Although the Makushi are still the primary ethnic group in the area, many communities contain a mixture of other indigenous groups and immigrants from the more populated coast. The primary livelihood activities in the area are subsistence farming and fishing, with some amount of hunting and gathering, trapping, brick making, and cattle ranching. The main local crop is cassava (*Manihot esculenta*), of which several varieties are grown to produce farine (roasted cassava grains), cassava bread, tapioca, and various beverages. There is also some local commercial exploitation of wildlife for the meat and pet trades. Wildlife represents a major local food source in the North Rupununi. Mammals and fish in particular provide the majority of the protein intake for villagers (Watkins *et al.*, 1999). According to a study by the Makushi Research Unit (Forte, 1996) over 100 species of fish are eaten by Makushi. As such, fishing is an extremely important subsistence activity. Aside from subsistence and economic value, the North Rupununi wetlands also feature prominently in indigenous culture and folklore, and have significant aesthetic value, serving as a primary place of recreation for local residents.

The residents of the North Rupununi are distributed among sixteen primary communities, consisting of approximately 5000 people. Although ten of these communities have legal title to some of their traditional lands, all of the communities currently practice customary user rights to their surrounding land and resources. The villages are represented by elected *Toshao,* or Captains. These leaders came together in 1996 to establish the North Rupununi District Development Board (NRDDB), a regional, community-based NGO, which currently acts as the coordinating body for conservation and development initiatives in the area.

3.2.2 History of the North Rupununi

The Makushi and other indigenous people have lived in the Rupununi for thousands of years. Fortunately, like elsewhere in the Americas, there has been a rebound in local indigenous populations, as the rights and cultural practices of indigenous groups are being regarded as an important component of maintaining a natural balance with nature and her resources. It has been approximately 60 years since the British colonial health service feared the Makushi population was close to extinction. Today, they are the second largest indigenous group in Guyana and the third largest in Brazil.

The Makushi and the Wapishana peoples have inhabited the Rupununi savannas longer than recorded knowledge, and were traditionally semi-nomadic, moving freely over the Rupununi savannas which extend into Brazil and Guyana and straddle the watershed divide between the Amazonian basin and the Essequibo River catchment, the largest drainage basin of the Guiana Shield. This watershed boundary was later used in 1926 to form the international boundary between Brazil and Guyana, thereby effectively splitting the established social-ecological system of the Makushi and the Wapishana peoples. However, even today, the international border remains a fluid entity and the passage of people from one side to the other is constant.

From the seventeenth century the Makushi and the Wapishana peoples became heavily involved in slave wars and trading events that linked the Rupununi savannas to the Portuguese and Dutch Ports on Guyana's coast. The Rupununi savannas first experienced aspects of European colonization, when a settlement was established by the Portuguese in 1773, in what is now called Roraima State. Later, in 1776, a stone fort was established at São Joaquim, at the confluence of the Takutu and Uraricoera Rivers. From this, the Rupununi savannas were seen as being suitable for cattle raising. In 1790, the first stock of cattle was introduced to the savannas. This introduction of ranching into the Rupununi became an additional livelihood activity for the people of the Rupununi savannas, in addition to farming, fishing, gathering and hunting, as well as balata bleeding and mining.

The development of the Rupununi continued apace. However, this came to an end following the Rupununi Uprising of 1969 (see Box 3.1). Since then, there has been limited investment in the region in the areas of services, facilities and economic initiatives, although more recent activities such as ecotourism (see *Current livelihoods and culture* section), have again opened up the area.

Box 3.1 Account of Rupununi Uprising (adapted from Colchester, 1997)

The Rupununi Uprising began on the 2nd January, 1969. Just three weeks after the rigged elections in Guyana, a group of white large ranch owners in the Rupununi, supported by a number of Amerindians, broke out in open rebellion against the Guyana government in the savanna area near the border with Brazil. The Amerindians involved in the uprising were mainly employees of the rebel ranchers who were Guyanese of European ancestry.

The police station at Lethem (the administrative centre of the Rupununi District) was attacked by ranchers, mainly from the Hart and Melville families, who were armed with automatic weapons. Policemen were riddled by bullets as they tried to escape. Annai and Good Hope stations were seized and the personnel held captive along with other Government officials and civilians in the abattoir at Lethem. Five policemen and one civilian were killed, the government dispenser was shot and wounded, and a number of persons, including the District Commissioner and his wife, were herded into the abattoir and held hostage. Without any time for dialogue or negotiation, the Guyana Defence Force flew in a well-armed unit and the rebellion was crushed.

A number of ranchers and Amerindians were killed. The rebel leaders were forced to flee to Brazil then to Venezuela, where many did find refuge. The crushing of rebellion led to strong criticism in the press: the government was accused of heavy-handedness and poorly substantiated allegations were made of massacres, mass burials, and the rape of Amerindian girls and pillage, while the rebels were also accused of misguiding political ambitions, unprovoked violence and murder. Unable to apprehend any of the presumed ringleaders or the ranchers who had fled across the frontier, the army took 28 Amerindians captive, ten of whom were not released for fifteen months though they were never found guilty of any offence. None of these half-truths have ever been properly investigated and the full tale of the rebellion has yet to be told. Instead the whole affair was followed by a cover-up with non-military personnel barred from entering the region for many years, which partly provoked the wild speculations about what had occurred. However, the action led to serious consequences for both the ranchers and Amerindians.

The government support for the ranchers was withdrawn, subsidized flight by the Guyana Airways Corporation were cut back and the cattle herd declined by 85-90% to only 12,000 head. It is thought that the revolt has led to continued questioning by the government about the loyalty of the Makushi to Guyana as well as various forms of discrimination against local communities.

3.2.3 Historical livelihoods and culture

The following sections provide brief descriptions on traditional livelihoods and practices and have been compiled using personal knowledge and material from Forte (1996) and Colchester (1997). It is not surprising that many aspects of local life and livelihoods were linked to natural resources – providing thatching for houses (species of palm leaves), source of food (wild meat), ornaments (balata crafting, basketry) and even local medicinal uses. Natural resource activities which contribute to local livelihoods include fishing, hunting, farming, gathering, subsistence logging, ecotourism and handicraft making. More detailed descriptions of natural resource use can be found in Forte (1996) and the State of the North Rupununi (2006).

3.2.3.1 Farming

In common with the other Amerindians communities in Guyana, the Makushi of the North Rupununi made their living from the natural environment primarily by slash and burn agriculture in the rainforest. Amerindian farmers used the traditional method of shifting farms which is a method best suited to the conditions of the forest and was a method that has evolved over centuries of experience and continues today. It has been criticized as a wasteful means of land use, however it have proven to be an effective means of cultivation without needing artificial fertilizers or pesticides.

In the past, Makushi farming was guided to a greater extent than it is now by their cosmological knowledge. Many decisions were taken according to the moon and markings would be made on the ground to indicate spatial and geographical features to others. In the Makushi calendar, the appearance of the 'seven stars' signifies that the onset of the rainy season is drawing close. During the rainy season, Makushi men generally chose the farm spots that they intended to cut during the following dry season.

In their prospecting of suitable sites in which to cut and burn a new farm, farmers generally take the following considerations into account: 1) proximity to creeks - not only to provide water for growing plants, but also for house hold use since people spend extended periods in their farm; 2) closeness of other relative's farms - Makushi generally cut their farms close to other relatives and friends for safety and support. Since many farming areas are located far from the community, the proximity of kin allows for socializing, for hosting a mayu (cooperative work) if and when necessary, and for getting assistance in the event of illness or accident; 3) absence of acoushi ant menace which can devastate crops- acoushi ants are generally less prevalent in a virgin forest; 4) soil types are also taken into consideration for the type of crops that are to be cultivated.

The main tools used for clearing the land were hoes, four–pound axes and cutlasses. Farming was generally a family activity, in which the males took primary responsibility for choosing the farm spots, and for cutting and burning the farm, while the women decided on what crops to plant, and generally devoted more time to weeding, reaping and transporting products to their homes. Men also erected temporary or semi-permanent structures in their farms, where the family lived while the women processed the cassava (*Manioc esculenta*), the staple food item, into farine, cassava bread, and drinks. Usually few families chose to live permanently in their farm places.

After the farm had been cut and burnt, the farmer moved any un-burnt branches to the spots which escaped burning, and there small localized fires were made. Watermelon and pumpkin were usually planted near to un-burnt tree stumps where they can benefit from decaying organic matter. A greater variety of crops would be planted in the ash rich soils. Ground provisions were generally planted in less rich soils of the farms. Farmers protected their growing crops in many ways from raiding wild animals by erecting scarecrows, noise-making objects as well as tying string around the whole farm.

3.2.3.2 Hunting

Hunting was done for the supply of protein and mostly around farming areas where game are generally drawn by the ripening of crops, or during the rainy season when animals are stranded on islands surrounded

by the flooded waters (see Table 3.1 for list of hunted wildlife). A good hunter is taught at a tender age. Fathers will make miniature bows and arrows for their young sons and praise them for their accuracy of aim. Traditional weapons included: the Kura (blow pipe); Rami (single wire arrow point); Rapo (arrow point made out of sharpened animal bone); Samaro (three pointed arrow); Sawato (arrow point that is not tied on, it is loose); and the Sisparari (special arrow made out of sharpened metal blades which are then tied to the arrow cane by using karauya (karawa) fiber and maitakin (karamani gum) that hold if fast - these arrows are suitable for large animal hunting).

Table 3.1. List of common wildlife hunted in the North Rupununi

Local Name	Scientific Name	Makushi Name	English Common Name
Bush Cow	*Tapirus terristris*	Waira	Brazilian Tapir
Watras	*Hydrochaeris hydrochaeris*	pranwei	Capybara
Savannah Deer		kîri yakî	White Tailed Deer
Bush Deer		Kusari	Red Brocket Deer
Land Turtle	*Geochelone carbonaria/ denticulata*		Red and Yellow Footed Tortoise
Yaci		Kiekan	Armadillo
Agouti/John	*Agouti paca*	Kuri	Red Rumped Agouti
Labba	*Dasyprocta agouti*	warana	Paca
Tartuga	*Podocnemis expansa*	warara	Giant River Turtle
Caiman	*Caiman crocodiles*	Kare	Spectacled Caiman
Caiman	*Melanosuchus niger*	Karatu	Black Caiman
Water Dog	*Pteronura brasiliensis*	Turara	Giant River Otter
Jaguar	*Panthera onca*	kaikushi	Jaguar
Wild Hog	*Pecari tajacu*	Parka	Collared Peccary
Wild Hog	*Tajassu pecari*	Pinkî	White Lipped Peccary
Anteater	*Myrmecophaga tridactyla*	tamanuwa	Giant Anteater
Deer Tiger	*Felis concolor*	sariwara	Puma

There are many traditions associated with hunting which are still respected by many. For example, when a hunter spots the track of an animal, he will cut a leaf off a nearby plant, place it on the track and then re-tie the leaf facing downwards in its former location. It is believed that this will cause the animal to re-trace its steps, thus making it an easier prey. A man will often make quite elaborate preparations in the period leading up to a hunting trip - applying bina (charm) on himself as well as his dog, abstaining from sexual relations, etc. In the Makushi world view, potential game is treated with respect, killed only on account of need. Many different methods of traps were practiced to catch different animals, as well as hiding spots especially at fruiting trees and in farms where there are fruiting crops. Different types of binas (charms) were used to hunt as well as training hunting dogs. Binas were made out of leaves and roots of different wild plants as well as different species of stinging ants.

Table 3.1 List of common plant species gathered in the North Rupununi

Plant name	Scientific Name	Plant name	Scientific Name
Wallaba	*Eperua* spp.	Itaballi / Moon Tree	*Vochysia surinamensis*
Mora	*Mora excelsa*	Balata	*Manilkara bidentata*
Cedar, Water Cedar, Swamp Cedar, White Cedar, Shingles	*Tabebuia insignis*	Shibidan, Lapani	*Aspidosperma vargasii*
Small lilies	*Nymphaea* spp.	Angelina Rock/ Wamaradang	*Dicorynia guianensis*
Moco moco	*Montrichardia arborescens*	Hububalli	*Loxopterygium sagotii*
Aripipi Palm	*Astrocaryum aculeatum*	Wild banana	*Musa* spp.
Lana	*Genipa americana*	Jamoon	*Syzygium cumini*
Congopump	*Cecropia* spp.	Mamvin	-
Inga, Whitee	*Inga* spp.	Mamma/Cassava Muma Tree	-
Guavaballi	*Iryanthera* spp.	Mariapret	-
Oldman back	-	Honey wood	-
Mahoo	*Sterculia* spp.	Meyai	-
Dalli	*Virola* spp.	Arrowa	-
Greenheart	*Chlorocardium rodiei*	Kunami	*Clibadium surinamense*
Bloodwood	*Vismia* spp.	Yarula	*Aspidosperma excelsum*
Kabocalli/ Kabukali	*Goupia glabra*	Aromata	*Clathrotropis brachypetala*
Big Lilies	*Victoria amazonica*	Aspeko	*Pouteria guianensis*
Ite Palm, Tibisiri	*Mauritia flexuosa*	Haiawa	*Protium decandrum*
Manni	*Symphonia globulifera*	Hubidi	*Anacardium giganteum*
Bamboo	*Guadua* spp.	Kufa	*Clusia grandiflora*
Water hyacinth	*Eichornia crassipes*	Krawa	*Ananas comosus*
Busy busy	-	Savannah mora	*Thyrsodium guianense*
Corkwood	*Pterocarpus officinalis*	Savannah greenheart	-
Kokrite	*Attalea regia*	Paurine, or lapenny	*Centrolobium paraense*
Mukru	*Ischnosiphon arouma*	Freijo	*Cordia alliodora*
Manni Tree	*Symphonia globulifera*	Kuru	*Astrocaryum* spp.
Bullet wood	*Manilkara bidentata*	Awara	*Astrocaryum vulgare*
Simarupa	*Quassia simarouba*	Nibbi	*Heteropsis* spp.
Silverballi	*Ocotea* spp.	Kauta	*Licania* spp.
Purpleheart	*Peltogyne venosa*	Bush cashew	*Anacardium occidentale*
Crabwood	*Carapa guianensis*	Wamaradang	*Swartzia leiocalycina*
Lu	*Oencarpus bacaba*	Wild Genip	*Muellera urens*
Turu	*Jessenia bataua*	Aciter	-
Leopard wood	*Brosimum* spp.	Genipap	-
Kakaralli	*Eschweilera sagotiana*	Bununi	-
Ocoballi	-	Mai-yea tree/ Bitter Tree	*Quassia simarouba*

Hunting parties can range from a lone man to as many as six men. While women do accompany hunting parties, pregnant and/or lactating women and small children are considered a bad omen for potential game. For example, eating the tapir, capybara, white-lipped peccary, is believed to result in babies sleeping fitfully and jumping all night, as well as crying all night. It is also believed that eating of left over food by a menstruating woman will cause a hunting dog to become stupid and lazy, and liable to loose the scent of the hunt.

3.2.3.3 Gathering

Gathering of plants and fruits was a common activity. Fruits were collected from trees such as kokerite, itea, lu, lucast, inga. Many wild fruits are in season in February of each year. Some fruits were known to be poisonous, and were not used for consumption, although they may have had useful medicinal purposes. Gum from trees such as the hiawa and balata was used as lamps to navigate in the nights especially while fishing and in most cases used at homes as candles. Mucru, nibbi and other plants were collected from the forest to make crafts such as baskets for agriculture purposes. Warshi and matapee sifters were also made out of these plants. Tables 3.2 and 3.3 list common plants gathered and their uses.

Table 3.3 List of non-timber products gathered in the North Rupununi

Plant name	**Scientific Name**	**Use**
Kokrite leaves	*Attalea regia*	roof thatching material; fruits are eaten
Mukru	*Ischnosiphon arouma*	basket making
Ite leaves	*Mauritia flexuosa*	roof thatching material; fruits are eaten
Lu leaves	*Oencarpus bacaba*	roof thatching material
Tibisiri	*Mauritia flexuosa*	wide variety of handicraft
Crabwood seeds	*Carapa guianensis*	to make crabwood oil
Buruhuda	*Parinari campestris*	bark used to treat snake bite; fruit can be eaten
Kakeralli	-	used to treat diarrhea
Greenheart	*Chlorocardium rodiei*	Seeds used treat for worms and general skin problems
Congo pump	-	Young leaves used to make beverage; young shoots are used to make flutes which are used in parishara dance.
Balata	*Mimusops globosa*	Fruit is eaten, latex for making of containers and ornaments.
Wallaba	*Eperua* spp.	used to make bows; bark used to treat internal injuries
Mora	*Mora excelsa*	Bark used to tan leather

3.2.3.4 Fishing

While fishing was practiced all year round, it was more difficult to fish successfully in the rainy season on account of the rise in the level of rivers and subsequent dispersal of fish (see Table 3.4 for list of common fish caught). During this time, people tended to fish with hook and lines. Many fishing methods were employed to ensure success, depending on the time of year and people's knowledge of the behaviour of fishes. Many men fished with bows and arrows by day and night, and while this was regarded a male preserve, some women were also recognised as being particularly skilful. Various arrow points were used: Arami - single pointed arrow to shoot medium-size fish; Sawato - drop point attached to line, used to shoot bigger fish; Samaro - to shoot warara, the largest river turtle; Takusi - to shoot big fish. Other methods ,such as traps, were used for smaller fishes: A'man - fish trap made from sticks which blocks off a section of creek; Maurai - fish trap woven out of mana (mukru) to trap fishes in narrow creeks; Penti - fish traps made from cotton twine, shaped like a mug with a curved handle; Tumu - fish trap made from plaiting thin strips of bush ropes into fine sticks to catch fishes in low ponds. Even poisoning was carried out at drying ponds where there was a need to quickly collect soon-to-die fish. While men often went fishing at nights or long before dawn, a couple also often went together to fish so as to share the tasks involved in catching and preparing fish for the journey home. Sometimes fishes were preserved through smoking on open fires. Sharing of fish among friends and families was common in the event there was excess amount of fish caught on a fishing trip.

Most prohibition on the consumption of specific fish was limited to pregnant women and /or lactating women and to small children. Certain fish species were not caught nor eaten when women were pregnant, lactating, or menstruating. Eating those specific fishes by the woman or her partner would result in their child becoming ill. People believed that the fish spirit is stronger than the spirit of the new baby and can cause harm to the latter. There were also different illnesses that were associated with eating different types of fishes at different phases in life.

Most fishing was done in the ponds, creeks and rivers found in the Rupununi. However, there were ponds that were referred to as 'Oma Ponds,' where persons were prohibited from fishing or visiting based on the advice of village elders. In addition, before the 1950's – 1960's, the Arapaima was not fished, as it was regarded as the 'Mother of all Fishes'.

3.2.3.5 Cattle ranching

The commercial cattle business in the Rupununi savannas began in the late 19th century with the arrival of colonial settlers from Europe. Between 1919 and 1953, the main trail for the cattle trade between the Rupununi region and the coast cut through present day Iwokrama Forest, as the Essequibo River was not completely navigable. The cattle trail closed in 1953 when transport was replaced by Dakota cargo airplanes. Cattle ranching continued successfully until the Rupununi Uprising of 1969 (see Box 3.1), after which it was almost permanently closed down.

3.2.3.6 Balata bleeding and the wildlife trade

The Balata, or Bullet Wood, is a tree that produces natural latex extracted by cutting into the tree. In the last hundred or so years, the forested areas of the Rupununi, including both the North and South were visited by balata bleeders (harvesters) from all around Guyana, including from the communities of the Rupununi. There was a trading post in Apoteri Village at the confluence of the Essequibo and Rupununi Rivers. However, by 1968, the balata industry began a downward spiral, although some balata bleeders continued the practice within the region. Many families in the Rupununi depended on the seasonal income that came from balata bleeding activities to enhance their subsistence needs. By the 1970s the balata market had completely collapsed, leading to a period of intense extraction of wildlife species, for sale to neighbouring Brazil. Animals that were heavily targeted during this period were the Arapaima, the Black Caiman for its skin, the Giant River Turtle, and the Giant River Otter for its pelt.

Table 3.4 List of fish species commonly caught in the North Rupununi

Family	Genus	Species	Creole	Makushi
Ageniosidae	*Ageniosus*	*brevifilis*	Dawalu	pîrapîrari
Auchenipteridae	*Parauchenipterus*	*galeatus*	Imehri	anuiya
Auchenipteridae	*Trachycorystes*	*trachycorystes*	Boots	amîri
Callichthyidae	*Hoplosternum*	*thoracatum*	Round-headed Hassar	kîriwou
Characidae	*Acestrorhynchus*	*falcatus*	Fox Fish	maikan
Characidae	*Astyanax*	*sp.*	Big-eye serebe	kamîya, sapuru
Characidae	*Brycon*	*falcatus*	Curumai	purumai
Characidae	*Metynnis*	*hypsauchen*	White Pacu	kumaru, waita
Characidae	*Myleus*	*pacu*	Cartabac	kamana
Characidae	*Pygocentrus*	*nattereri*	Cashew Perai	suyu arai
Characidae	*Serrasalmus*	*niger*	Black Perai	riktun arai
Characidae	*Triportheus*	*rotundatus*	Basket Fish	pîkarumá
Cichlidae	*Cichla*	*ocellaris*	Lukunani	kamakara
Cichlidae	*Crenicichla*	*alta*	Sunfish	kurapi
Cichlidae	*Geophagus*	*surinemensis*	Sand Grinder	saimaka
Ctenoluciidae	*Boulengerella*	*cuvieri*	Sword Fish	moruwi
Curimatidae	*Leporinus*	*friderici*	Dare	kîmîiyari
Curimatidae	*Prochilodus*	*rubrotaeniatus*	Yakutu	kîmîta
Cynodontidae	*Hydrolycus*	*scomberoides*	Baiara	
Cynodontidae	*Hydrolycus*	*armatus*	Creek Baiara	wînni, paya
Doradidae	*Hassar*	*notospilus*	Bitter Head	maipupai
Doradidae	*Pseudodoras*	*niger*	Zip Fish	kuyun kuyun
Erythrinidae	*Hoploerythrinus*	*unitaeniatus*	Yarrow	karasai
Erythrinidae	*Hoplias*	*aimara*	Haimara	aima
Erythrinidae	*Hoplias*	*malabaricus*	Huri	patakai
Erythrinidae	*Erythrinus*	*erythrinus*	Bush Yarrow	woyomari
Gymnotidae	*Electrophorus*	*electricus*	Electric eel	a'rinra
Loricariidae	*Ancistrus*	*hoplogenys*	Banjuman	ariwa
Osteoglossidae	*Arapaima*	*gigas*	Arapaima	warapai
Osteoglossidae	*Osteoglossum*	*bichirrosum*	Arawana	arauwuna
Pimelodidae	*Pimelodus*	*blochii*	Johnny Mangy, Larima	katîrîna
Pimelodidae	*Pseudoplatystoma*	*tigrinum*	Long-head Cullet	ararama
Pimelodidae	*Pseudoplatystoma*	*fasciatum*	Short-head Cullet	kurutu, karama
Pimelodidae	*Rhamdia*	*quelen*	Kassi	rekî
Potamotrygonidae	*Potamotrygon*	*sp.*	String Ray	sipare
Sciaenidae	*Pachypops*	*grunniens*	Small Basha	siriki
Sciaenidae	*Plagioscion*	*sqamosissimus*	Basha	pakupa

3.2.3.7 Traditional homes

Traditionally, the Makushi built the following four styles of houses: Pauwi yaki - sloping shed, resembling the powis' tail; Tousipan - benab; U'ti - complete building; Wayumuri - little wall-less house, with only roof. The majority of houses were adapted to savanna conditions- solid walls out of wattle and daub or clay bricks to keep out the cool breezes of the dry season. Palm leaf thatching and mud-daubed walls and floors were the most common types of homes that were built. Most houses also had an inner partition and an extension that formed the kitchen or even a separate kitchen situated a short distance away from the main house.

As in almost all aspects of their daily life, Makushi had to range far from their savanna homes into the forests, mountains and rivers to gather the raw materials needed for house building. Most men built their own homes, aided by their immediate family members and by holding a *mayu* (cooperative work) to fetch the house materials from the forest or get the main structure erected. The choice of palm thatch and timber used largely depended on what material was available in the surrounding forest. In the vast majority of instances, house material were transported on the backs and shoulders of householders or dragged through the savannas. In the case of the riverine villages, transportation was by paddling canoe.

3.2.3.8 Illnesses and medication

Below are some illnesses and the traditional practices for curing them:

Haemorrhaging - to stop the flow of blood after a miscarriage, the roots of palm saiye' (*Euterpe oloracea*) was used.

Abortion - the root of Kupaiye' (*savanna iteballi*) was formerly used to induce abortion.

Baby care - Makushi parents lavish a great deal of time and care for their babies. A baby was seldom parted from its mother. Makushi parents followed many injunctions when their babies and young children were ill. The parents of a sick child would neither have sexual intercourse nor eat foods cooked with pepper or casreep. Many other ways of healing were done and practiced for baby care.

Malaria - historically , and continuing right into the present, malaria has been endemic in the Rupununi region and now ranks as the chief source of illness in Makushi communities. Malaria rates tend to be high in the rainy season when the mosquitoes are plentiful. Traditionally, malaria was kept under control by drinking bitter-tasting plant extracts, one of which is the cincona bark.

Gastrointestinal disease and worm infestation - the term *wenru* is used to refer to thread worms in the anus, a condition that affects babies and young children in particular. A child with this condition sleeps fitfully, his anus is 'red' and sore, and his legs feel cold to the touch. A number of remedies were used for this ailment, including kuti, the greenheart seed, crab oil and soot from the fireside.

Skin problems - the Makushi used a wide variety of remedies against skin problems which are considered a perennial problem. People developed 'ground itch' (probably a fungal infection) particularly during the rainy season when their feet are immersed in the 'dirty' water along the farm roads and in the flooded savanna. Mothers say that one of the reasons for giving their children bitter teas to drink like carila bush or sweet broom is as a prophylaxis against ground itch and other skin diseases.

Bloodletting - in the Makushi medical system, bloodletting is employed for a number of medical conditions including treatment for nagging headaches and as a prelude to the application of a number of bina. The blood released is considered to be 'bad' blood, black in colour and containing within it the source of the pain. In the case of persistent headaches, the skin between the eyes is pinched and then punctured with the sting of a sting ray. It is known and believed that as the blood flows from the spot, the headache is relieved.

Anti-venom and snake bites - five distinct plant preparations to counteract snakebite are gathered. Three are prepared from tree bark and the others from roots. When recovering from the bite of a snake or piranha, eating pepper or casreep was prohibited. It was also believed that nor should a person step on fowl dung because this would irritate the wound. Another form of 'protection' was supplied by a caiman's tooth, which some people carried around with them tied to a string around the neck or in the pocket. The caiman tooth was thought to protect a person from getting bitten from snakes.

3.2.3.9 Social organization

Settlements were smaller in the past, family units more cohesive and the ethos of sharing and togetherness, under the direction of strong leaders, was a defining characteristic of life. People were accustomed to a more mobile lifestyle. In the old days, there was more inter-community work, feasting and celebration called the matri-man and also known as the *mayu*. An individual would host a *mayu* or self help activity in which he/she would invite other members of his/her community. This activity was a way of helping each other in work, in a time when the dependence was on the strength of men and not on that of machines. Upon completion of the tasks for the day, the participants would get together after labour to socialize and enjoy their main beverage, the parakari, an alcoholic drink made from fermenting cassava.

3.2.3.10 Rituals and beliefs

Traditionally, the Makushi interpreted any manifestation of illness as resulting from the presence of an evil spirit. These spirits lurked everywhere and awaited any crack in the defences erected against their entry. As a result people were constantly on their guard. The forces of evil were thought especially keen to attack the young and defenceless, a predilection the Makushi counteracted by constant vigilance over the young, and a vast array of dietary precautions which had to be observed by the baby's parents. Additional measures against the omnipresent threat of evil involved purification of the body, through baths infused with special barks or leaves, and by taking potions to rid the inner body of impurities, often through 'making the blood bitter'. In the event of serious illness, the intercession of a ritual specialist – the piaman – was sought out. The piaman was thought to possess supernatural powers and was able, with the aid of more powerful spirits, to counter the evil manifested in illnesses. Through the medium of dreams and visions, he was able to diagnose the source of evil and set himself up to combat it. He performed ritual healing ceremonies over the sick person, with the aim of driving out the evil spirit by the use of more powerful spirits. The piaman rituals made use of many forest products, such as leaves from fragrant trees.

In addition, the piaman was well versed in the preparation of plants medicines which he prescribed and administered to the sick person. Formerly, these ritual specialists wielded great power over their people, often doubling as tribal leaders.

Other beliefs involved the moon. For example, it was believed that a white circle shadowing the moon was a sign of starvation. When the sun is ringed by the same white shadow, it was interpreted as sign of rains. It was also believed that root crops planted during the full moon period yielded a fuller harvest.

3.2.3.11 Transportation and communication

Many Amerindians relied on manual means of transport through walking or the use of a canoe. There were known to be great journeys made by foot or canoe up to weeks at a time. One way of communicating between groups of Amerindians was by leaving signs printed on trees and rocks (seen today in the form of petroglyphs), either for security or danger.

3.2.4 Current livelihoods and culture

The Makushi have arrived to the present day, after some 350 years of contact with the world outside, at a time when all people are aware of the ecological dangers of the style of resource consumption characteristic of western civilization. Their options to protect natural capital are limited by their poverty in market economy

terms and their rights to traditional land, but the North Rupununi villages are involved in collaborative work with local and international organizations, in the effort to learn ways of making resource exploitation sustainable.

Today, the Rupununi is divided into the North Rupununi, Central Rupununi and South Rupununi districts. These sub-regions of the Rupununi area make up the Administrative Region #9 – Upper Takatu/Upper Essequibo – of the country's 10 regions. The communities of the North Rupununi and its resources fall under the jurisdiction of many local, regional and national bodies. Most village councils in the area enjoy some level of control over everyday management of resource use in their areas. The village councils of titled have jurisdiction over some of their land resources while non-titled communities do not enjoy formal rights to their land and resources. Such lands are under the legal jurisdiction of a mix of government agencies. Figure 3.4 shows the land demarcation for communities of Annai District, Massara, Toka and Yakarinta.

Over the past decade or so, rapid change in Guyana has affected the Amerindian population, where some communities within the North Rupununi find themselves in the midst of conflicts, where the land they reside upon or live next to is given as a concession to loggers, miners, resort developers or conservation areas. The impact of external influences has been varied in the North Rupununi. In some aspects of culture, for example, music, dance, clothes and food, there is a strong change in culture from traditional forms to modern ways, and influenced primarily by Brazil and Georgetown. However, in other cases, for example, livelihood activities including farming and fishing, traditional methods are still employed although there may have been changes in aspects such as tools.

3.2.4.1 Farming

Agricultural production remains the backbone of the Amerindian livelihood in the Rupununi, as it is for so many people in Guyana. For the Amerindians, it also reflects their dependence on the land, a relationship dating back hundreds of years and a long time before the ancestors of the current Guyanese population entered the country. Traditional, small-scale farming methods are still being practiced in most of the communities, as outlined in the Traditional livelihoods and culture section above, and there is a gradual increase in the number of households gardening close by in their backyards (home gardens). The more recent history of farming in the Rupununi however, includes some amount of cash crops, and sale of farm produce, but today this is still very small-scale. One of the prime commercial crops that commenced in the Rupununi was peanuts. During the post-Rupununi Uprising period, the government encouraged commercial agriculture such as peanut farming within the region. Produce was shipped by air to the coast. Many households converted mix-crop farms into peanut production. However, the peanut market collapsed in the 1980's leaving farmers without agricultural cash source and many farmlands significantly eroded. Despite much effort on the part of the peanut farmers, the scale of peanut farming was never able to make up for the loss of income when the balata industry ceased and the cattle ranching activities in the region, were reduced.

3.2.4.2 Hunting

The introduction of guns to Amerindian people has impacted tremendously in the sense that some people have lost the skill of using bows and arrows. However, other aspects of hunting, including the organisation of hunting trips planned by leaders, remain the same. Today, the most common animals that are hunted are all of the large animals, such as the labba, peccaries, tapir, deer, agouti, capybara and some large wild birds such as the Muscovy duck and the powis. Communities, however, have and are in the process of putting in place management systems for hunting, to ensure the sustainability of hunting in the long-term.

3.2.4.3 Fishing

The major change in fishing practices has been through the introduction of new fishing tools, including nets and lines. A variety of methods are used depending on a number of factors, such as the time of year, habitat type, and fish species being sought. Seine nets are set and traps built for fish moving down river

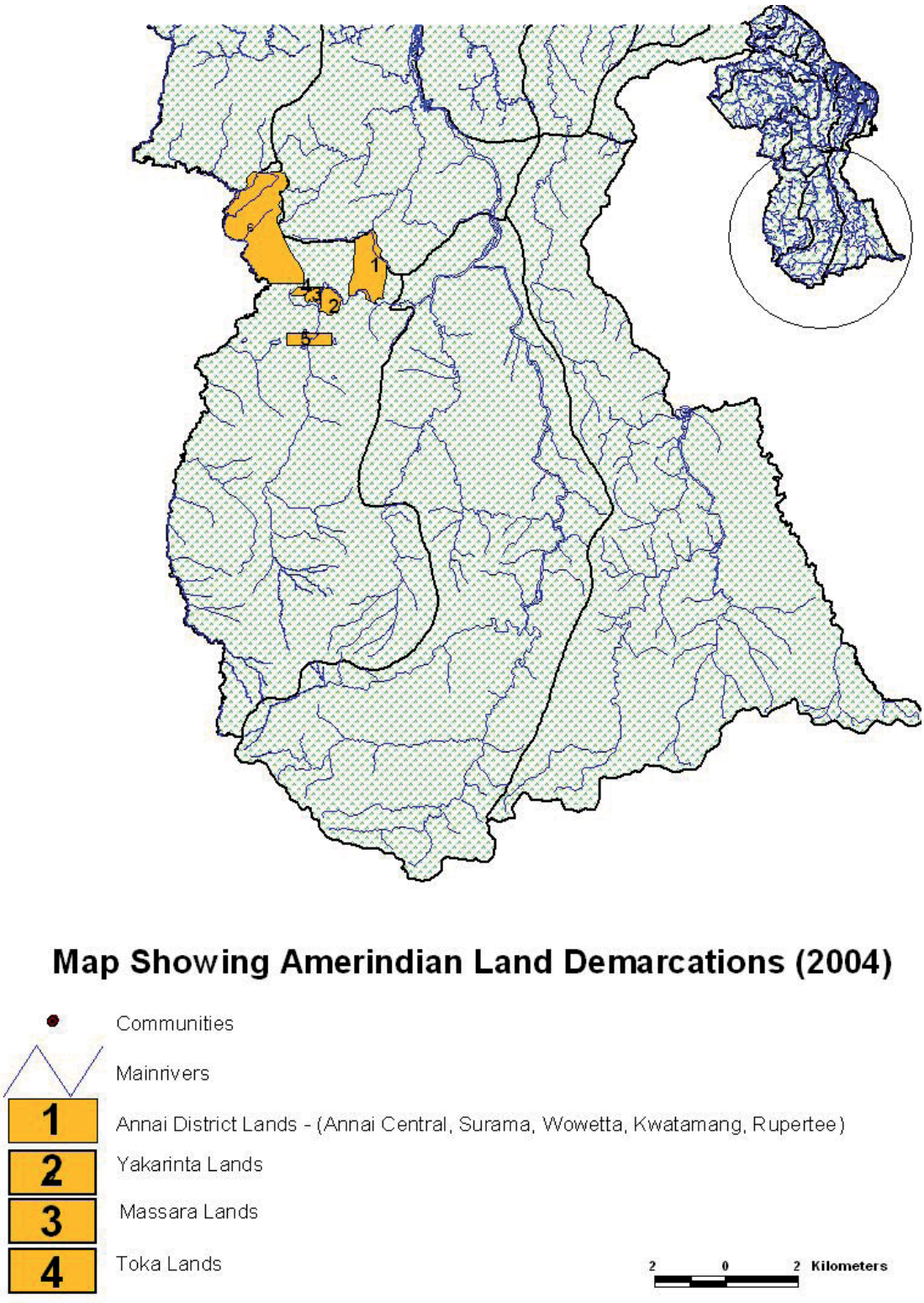


Figure 3.4 Map showing land demarcation in the North Rupununi

after spawning in the headwaters, as the waters drop from their peak at the height of the rainy season. The most common and reliable method is the seine net, which is placed throughout the rainy season in savanna lakes or deep pools in major rivers. Line fishing is used at times of low water, and may also be used to catch particular species. Some fish are still caught with bows and arrows, but on a smaller scale.

Some specialised techniques, such as spring rods, are applied to particular species of surface-feeding predatory fish. Large predatory fish may also be caught with lines strung across waterways at night, from which hooks are set near the water's surface at regular intervals. Poisoning of fish is rarely practiced today, mainly because of the concern about environmental damage and the destruction of most of the fish and other animal life in the pools, including fish too small to be worth catching. Poisoned pools are also dangerous to livestock grazing on the savanna, and cattle and other domestic animals have on occasion died as a result of drinking from them. However, some people still practice poisoning activities at a minimum basis when it is necessary.

3.2.4.4 Other commercial livelihood activities

There are currently a number of small-scale commercial livelihood activities taking place in different villages around the North Rupununi. These include brick-making, bee-keeping, handicraft production, aquarium fish trade, soap and ointment production and peanut butter production. Ecotourism is by far the largest income-generating activity currently taking place in the area, with a number of villages engaged in a wide variety of tourism activities including bird-watching, river tours, local cultural tours and mountain hikes.

3.2.4.5 Infrastructure

In recent years, many community members have begun building homes with zinc sheets for roof and burnt bricks for walling as well as boards and many other manufactured materials. However, many community members still build homes using traditional materials and methods. The communities of the North Rupununi have the minimal infrastructure in place with regards to roads, transportation, law enforcement, health clinics, schools, telecommunication, water supply and electricity. Lack of finances coupled with general accessibility to some communities may account for the present basic infrastructure within individual communities.

Presently no asphalted roads exist in the North Rupununi. However, there is increasing talk about the main road from Georgetown to Lethem being upgraded. All existing roads which allow vehicles to traverse have been cleared by community members – these include access roads to individual villages and to river landings. Many of these roads become inaccessible by vehicle during the wet season, and so some villages can only be reached by boat at these times.

There is no piped water or electricity connection in the North Rupununi at present. People use hand dug as well as pump wells to access ground water. Water is also used from rivers and creeks, and many households harvest rainwater from their buildings. Energy for electricity is sourced by solar panels, car batteries, flambo lamps and generators.

Most communities in the North Rupununi have a nursery and primary school, with the only secondary school being located at Annai Central. Churches of various denominations and health centres are also present in all the villages. The police station is situated at Annai Central.

All communities are in contact with each other and the outside via HF Radios. Some communities have the technology to make calls to telephones via the HF Radios. There also exists Radio Paiwomak (FM 97.1), the first hinterland community-managed radio station which began broadcasting in 2000. It is operated out of the Bina Hill Institute under the umbrella of the NRDDB and presently serves nine of the area's communities.

The community of Annai Central has a pay-phone booth which allows calls to Lethem and the Coastal Network. Infrastructure for landlines and cellular networks does not exist. The main Internet access point is at the Bina Hill Institute, although Surama and Yupukari also have Internet connection through expensive satellite link-up.

3.2.4.6 Religion, language situation and ethnicity

All the villages in the North Rupununi now have at least one church of a Christian denomination. Although most people would identify themselves as Christians, everyday life sees a blend of traditional beliefs and Christian values being practiced simultaneously. The communities are overwhelming Makushi, with a minority of outsiders, including other Amerindian ethnicities (e.g. Wapishana) and non-Amerindians, gradually adapting and conforming to a Makushi lifestyle. Some older people are monolingual in Makushi, possessing only a few words of English. Most people, however, speak Makushi and English, and many are fluent in Portuguese. English is the only language taught in schools. Often the persons literate in Makushi tend to be those who attended Bible study classes in Makushi while based in Roraima state, Brazil. While there are many inter-village marriages between Makushi and non-Makushi, there are only a few non-Amerindians permanently resident in the predominantly Makushi communities.

3.2.4.7 Present day celebrations and community events

Makushi gather to celebrate birthdays and the return of family members from other parts- Brazil or from the coast- with feasting and dancing, often for few days until the parakari runs out. Major celebrations are also held around Christmas, Easter- the rodeo- and during the August school holidays. People also gather when there are regional activities like intra- and inter-regional school sports, which are very popular with parents too, and the visits by politicians or leading church members. In recent years, events have been planned to mark occasions like Mashramani week, Amerindian Heritage Month and World Food Day, as well as the annual Wildlife Festival organised by village wildlife clubs. Rodeo celebrations- held at Lethem and in the past held in Annai- are counted as being the most exciting in the calendar.

Preparations for Christmas celebrations go on all during December. Men fish and hunt while women prepare various kind of wine from mango, cashew, (mukuriri), corn and potatoes- in addition to parakari. The churches also tend to organize some activities that include sports competitions and sharing of food, even archery and cotton spinning competitions. Not to forget, many individuals have adapted to spend their earnings on alcoholic beverages manufactured at private businesses which tremendously affect families socially.

3.3 Decision making institutions for natural resource management in the North Rupununi

There are a variety of national, regional and local, as well as governmental and non-governmental organizations that play a key role in decision making for natural resource use and management in the North Rupununi (Figure 3.5). However, "although there are a range of agencies in charge of the North Rupununi Wetland resources, it is clear that these do not have the capacity to monitor conditions or enforce resource use law. At present, it seems that the major roles of these agencies are to develop resource use policies and to issue resource exploitation rights to external multinational companies and enterprises. Monitoring and control of these enterprises by government agencies has also been inadequate as exemplified by the catastrophic breach of the Omai gold mine tailings dam in 1995" (State of the North Rupununi Report, 2006). In addition, there seems to be a problem with coordinating activities between different agencies, leading to conflict situations. For example, the EPA may be advocating the designation of the North Rupununi Wetlands as a conservation area while at the same time the GFC may be looking into assigning logging concessions in the same area.

All these local, regional and national organizations are governed by laws and regulations at both the international and national level. A brief description of these and how they may affect the NRAMP is given in the Appendix. Yet, implementing some of these policies, as well as being able to made appropriate decisions, can be extremely problematic due to the lack of capacity within institutions, communities and individuals. This lack of capacity is related to resources such as finance, equipment and technology, but equally as important, human resources including knowledge and skills. The latter is impounded by inadequate education and health facilities, particularly accentuated for the communities of the North Rupununi.

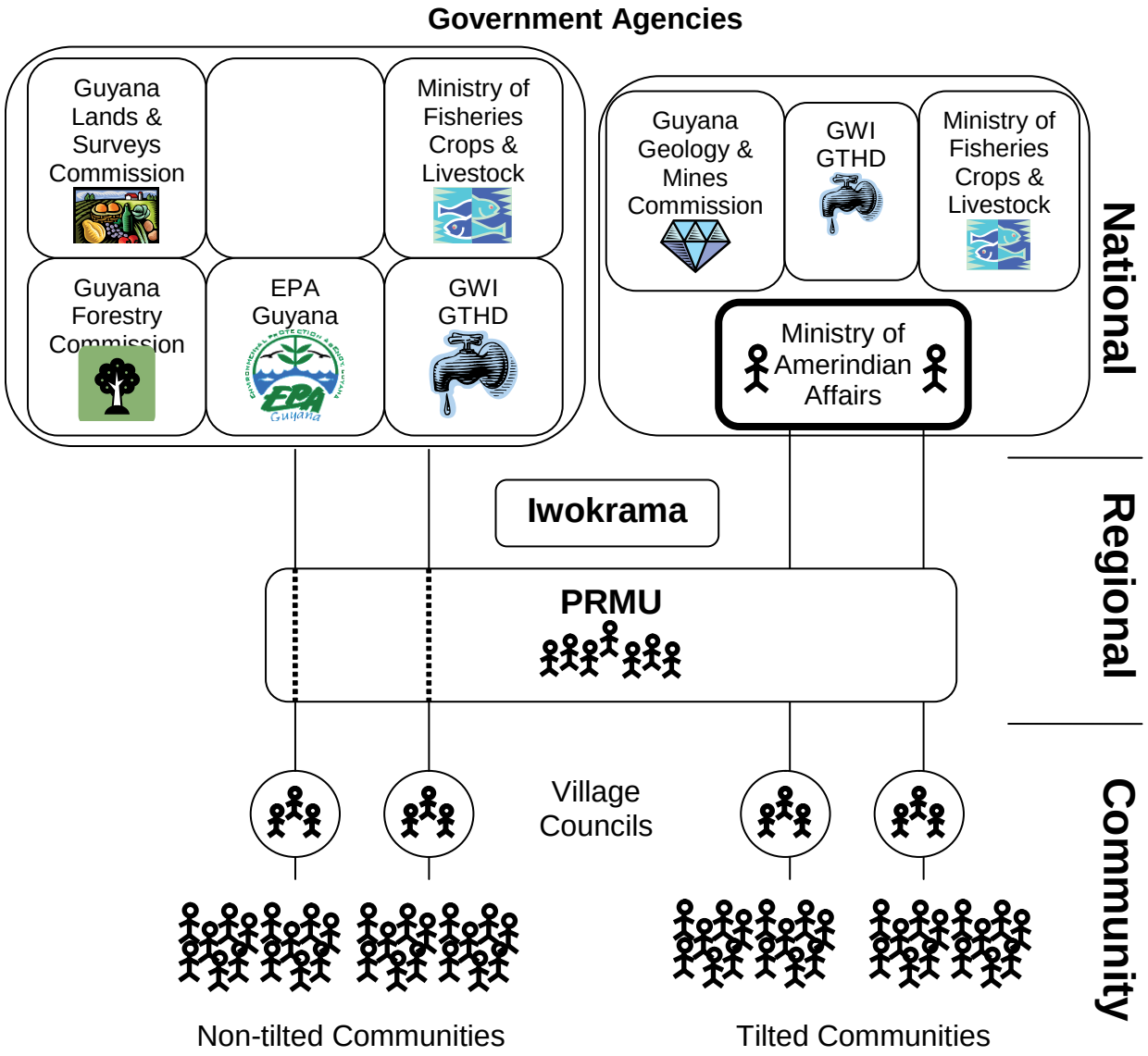


Figure 3.5 Primary groups and agencies with legal jurisdiction over natural resources in the North Rupununi (from the State of the North Rupununi Wetlands Report 2006). PMRU = Piyakiita Resource Management Unit; EPA = Environmental Protection Agency; GWI = Guyana Water Incorporated; GTHD = Guyana Transport and Harbours Department.

4. NRAMP Methodology

4.1 Introduction to methodology

NRAMP champions need to acknowledge that different stakeholders have different capacities to deal with different levels of complexity. Some stakeholders have a wish to develop more specialised roles in order to deal with the complexity. For example, some stakeholder groups have administrative staff, financial managers, field assistants etc, all with specialised roles to help engage with different aspects of a complex situation. Other stakeholder groups have limited specialisation, with members expected to deal with a wide range of issues.

One of the principal mechanisms through which societies deal with complexity is with the creation of specialised institutions. Each institution is placed in charge of dealing with a specific and limited purpose, whether it is education, governance, agriculture, defence, transport and so on. And each of these institutions has a specialised set of professionals: from technicians to accountants to managers.

We recognize that the development of specialised institutions to deal with natural resource management in the Rupununi is still at a very early stage. So the NRAMP methodology proposes two different approaches to adaptive management: one which focuses on supporting institutions, and one which focuses on supporting communities. For institutions, the NRAMP methodology can be used as an international standard for managing ecological and human health, which can feed into broader agendas of sustainability and poverty alleviation. Not all of the associated indicators may be appropriate for communities whose interests may focus on particular local concerns. Thus, for communities, the NRAMP methodology can be used to focus on engaging people in developing their own management approach, including the selection of indicators of interest.

4.1.1 Institutional interests

For institutions, the NRAMP can be employed for a range of potential users and uses. These include: government departments and agencies involved in water resource management, agriculture, forestry, mining etc. – e.g. EPA, Hydromet, Ministry of Housing and Water , Guyana Forestry Commission etc.; conservation non-governmental organisations – e.g. Iwokrama, Conservation International, Karanambu Trust, World Wildlife Fund etc.; private companies involved in forestry, agriculture, mining etc.; community organisations involved in forestry, agriculture, tourism etc. – e.g. NRDDB etc.; environmental consultants undertaking Environmental Impact Assessments, biodiversity monitoring etc. on behalf of government or private companies. The approach has been designed to be flexible so that different users can develop it for their specific needs.

The NRAMP is a holistic approach to environmental monitoring and management, and replaces the simple monitoring and management of water quality, species or land use in isolation. The outputs provide a clearer understanding of ecosystem health and the impact human land use activities have on the environment and the people who rely on the natural resources. The approach can be used to develop long-term monitoring of ecosystem health and resource use and to develop ecosystem health indicators that can be used for more rapid assessments. The following lists some of the specific uses this approach can be used for:

Long-term monitoring

- Long-term monitoring of ecosystem health and natural resources of both protected and non-protected areas to assess local, regional and national goals for biodiversity conservation and resource use;
- Monitoring of the impact of a water or land use change, such as forest to intensive agriculture, to assess the impact on ecosystem health and natural resources;

Rapid Assessments

- Environmental Impact Assessment of a proposed development, industrial activity or water use change such as abstraction or damming to assist in planning decisions;
- Post incident monitoring, such as an industrial pollution incident, to assess full impact on ecosystem health and human natural resource use to help develop mitigation measures and to aid any potential prosecutions.

4.1.2 Community interests

The situation with which local communities currently find themselves in within the North Rupununi is of significant concern. Levels of illness, nutrition, employment and education worry many individuals. It is therefore understandable that local communities may want to focus on addressing immediate concerns such as these, as opposed to whether levels of natural resource exploitation will result in scarcities in the long-term future. It is the intention of the NRAMP to reconcile immediate and long-term concerns in a process that balances these in an open and frank discussion among community members and other stakeholders. It is therefore recognised that communities may wish to propose their own indicators of social and ecological viability which are appropriate for their concerns and are easily communicable amongst the communities and with other stakeholders.

However, the significance of adopting a participatory, adaptive, holistic, practical and evidence-based approach is undiminished even in these circumstances. The NRAMP encourages communities to adopt a learning approach to goal-setting, observing, evaluating and planning as outlined below.

4.1.3 Information management

The greatest obstacle to sustainable development is the absence of a shared understanding. A shared understanding can be described as the knowledge, techniques, skills, procedures and values that are held in common by a community. The more there is in common between community members, the easier it is to coordinate efforts and adapt to changing demands. A strong shared understanding plays a crucial role in the development of trust, overcoming the negative impacts of differences in power and knowledge. It provides a greater awareness of the capacity of community members to achieve certain objectives while at the same time creating a platform for interaction. This can be achieved utilising a wide variety of media which include reports, cartoon strips, plays, videos, newsletters, three-dimensional models, exhibitions and oral presentations.

4.1.4 Goal Setting

To provide a focus for management of natural resources and to direct stakeholder effort it is important to establish a shared goal. This is the first step undertaken within the adaptive approach to natural resource management. For example, a stakeholder group may want to address the specific problem of a declining fish catch and scarcity of timber for building as part of their overall management process. This may come into conflict with other stakeholder priorities and objectives. To address these potential conflicts, the first step is to reach initial stakeholder consensus on the exact nature of the problem and what goal or goals need to be established. This stage of the process will require NRAMP champions to facilitate an intensive phase of negotiation amongst stakeholders.

The negotiation process should also take into account different spatial and temporal scales in goal setting. For example, a stakeholder group may want to continue eating fish, so in the face of declining fish numbers the long-term goal they set could be to develop a management strategy to maintain fishing and therefore fish populations at sustainable levels. However, the short-term immediate goal may be to halt the decline of fish numbers. They may also set a goal to ensure adequate timber supply in the future. Although there may be overlap in some activities, each of these goals may require distinct learning processes to address specific issues.

4.1.5 Observing

This phase focuses on the collection and recording of information in relation to the goal(s) established by stakeholders. Of course it is impossible to collect data on all the issues of interest, especially in situations where human resources are limiting and logistics are difficult. The first task in the observation stage is therefore to develop a simple representation of the situation, highlighting the most important features. This task can be referred to as 'modelling'. Once a model of the situation is developed, one can proceed to the data gathering stage. The data collected can be referred to as 'indicators' since they can help us build and verify the model. This may involve collecting data through primary and secondary sources and displaying the resulting information according to a format that can be easily understood and accessed by different stakeholder groups.

4.1.6 Evaluating

Evaluation is about using monitoring and other information collected to make judgements about whether the management goal is being achieved or not. It is also about using the information to make changes and improvements to the overall process. The evaluation of the information collected and identifying problems and opportunities involves an analysis of the information against a set of social and ecological criteria. Stakeholders will be able to identify problems and opportunities within the current situation or which may emerge in the future if current trends continue. Some individuals may find it relatively straight forward in developing criteria or thresholds for indicators, but it is important to understand that evaluating the indicators or progress towards a management goal is based on stakeholders' own specific values and ethics.

As we all have different ways of valuing and judging components it is important to develop a consensus among stakeholders when undertaking the evaluation phase. It is in the evaluation phase that a decision needs to be made on whether stakeholders are ready to move on to the next phase of the adaptive management process and develop a plan of action, or re-visit the goal setting and observation phases until there is sufficient confidence in the type and quality of information collected to go to the next stage.

4.1.7 Planning

The planning phase involves developing a plan of action to put into reality the agreed goals. The plan should clearly state the objectives (why are we doing this?), expected outputs (what do we want to get as a result?), activities (how are we going to do it and when?), measures of progress and success (how do we know we've done it?), assumptions (what do we need in order to do it?), and responsibilities (who is going to do it?). A commonly used technique to compile the answers to these questions is the development of a "logical framework" or log-frame for short.

4.1.8 Implementation

This phase is where stakeholders actually go and do something that has the potential to change the situation. Initially, NRAMP may have very little "action" i.e. impact on the ground may not happen for a while as people spend most of the time sharing visions, gathering information and evaluating. Some people may argue that one is actually carrying out a form of implementation during the planning, observing and evaluating steps of the adaptive management process. We would actually like to emphasise here that NRAMP focuses on bringing tangible improvements to the North Rupununi wetlands and the communities that depend on them for their livelihoods. So, in our case "action" does not include the "see and talk" element (i.e. observation and evaluation) -- action is about attempting to make a real improvement on the ground -- and it should be measured in terms of, for example, recovering the populations of *Arapaima*, or reducing the number of children dying of wetland related illnesses such as malaria or dysentery. NRAMP is not intended to be an "all talk no action" process.

4.2 Goal setting and re-setting activity

The goal setting approach presented in this section is aimed towards achieving the combined health of both communities and ecosystems on which they depend. Within this system health or viability framework, scenario analysis, visioning and stakeholder negotiation techniques can be used to set goals.

4.2.1 System health properties

Although the community and wetland health ethics of ecological sustainability and social justice provide a long-term vision for natural resource management, specific short-term to medium-term goals need to be set to achieve this. These goals can be developed using the system health properties, described below and by Bossel (2001), in combination with scenario analysis and/or visioning presented in the following sections.

A community or wetland that is not subject to external changing conditions can be described by two system health properties; *existence and ideal performance*. These system health properties are defined as questions below:

Existence – Does the community or wetland have the basic requirements to exist?

For example, the basic requirements that allow a rainforest ecosystem to exist are plants, animals, nutrients, water and solar energy. The basic requirements for a community are shelter, food, water and health. Without any of these basic requirements a rainforest ecosystem or a community would not exist.

Ideal performance – Is the community or wetland working well?

For a system to be working well it requires system processes to be performed at the optimum level and numbers of components to be at an optimum level. For example, if an area of rainforest is working well, all processes such as germination and the numbers of elements such as Howler Monkeys, would be at an optimum level. For example, a community is working well when a component such as income generation is achieved through efficient working to allow adequate time for other important activities such as spending time with the family. If the system exists but not all processes occur at an optimum level or if some elements are under represented then the system would not be working well.

When external conditions are changing then to maintain the existence and ideal performance of a system additional system health properties are required; resistance, flexibility and adaptability. These system health properties are defined as the following questions:

Resistance – Can the community or wetland stay the same with changing conditions?

For example, within a rainforest one bee species could be crucial to pollinating five different plant species that provide food for numerous bird and mammal species. The rainforest ecosystem would have low levels of resistance to a disease affecting this particular bee species because without it the five different plant species would not be pollinated and the food resource would be lost. A similar rainforest with five bee species that fulfil the same role would have a higher level of resistance as the loss of one bee species through disease would not stop the pollination of the plants and the continuation of the food resource. Similarly within a community, if for example, there are strong family ties within the community, the community is more likely to withstand difficult times. However, if the family is loose then the ability of the community to withstand hardship will be small.

Flexibility – Can the community or wetland accommodate changing conditions using existing resources?

For example, a rainforest ecosystem could be described as flexible if, after the forest has been disturbed through forestry activities, plant species can recolonise as there are sufficient nutrients and an available seed bank within the soil. If colonisation cannot occur because there is a lack of nutrients in the soil and a limited seed bank then the rainforest ecosystem would not be flexible. Within a community, having diverse

livelihoods and physical mobility, for example, would allow the community to cope with changing conditions as they could focus on a different livelihood activity or gather resources from another suitable area.

Adaptability – Can the community or wetland adjust to changing conditions using new resources?

For example, a rainforest ecosystem could be destroyed by a large scale catastrophic mudslide. However, it would be described as being adaptable if recolonisation of the plant species could occur through a river system transporting seeds and animal species from a rainforest ecosystem further up the river catchment. If the destroyed rainforest ecosystem was not connected to another rainforest through physical transport processes such as a river flooding then the current rainforest would not be adaptable. For a community to adjust to changing conditions through using new resources there would need to be individuals within the community that are educated and have a range of skills to cope with the changing conditions.

4.2.2 Scenarios

Scenarios are stories of *what might be* (Wollenberg *et al.*, 2000). They can help build a shared goal of a desired future and help to understand how interventions or activities may impact on people and the environment. In their simplest form, they can be a vision for the future and then by comparing the present day situation, pathways can be developed to reach the vision. This simple technique can be very effective in helping to develop a shared goal. Box 4.1 outlines how visioning was used during a stakeholder forum in the North Rupununi to develop goals for the future.

Box 4.1 Example of using visions to develop shared goals

In September 2007, a stakeholder forum comprised of toushaos, men, women, elders and youths, was convened with the aim to gather the collective vision (goal) of the people of the North Rupununi based on the current status of the region and their livelihoods, and to develop a plan on what, how and what would be necessary to allow for this combined vision to be achieved. The forum was facilitated using the visioning approach. Participants were given the idea of two banks of a river, where the opposite bank was the vision, the bank they were standing on was the current situation, and they had to build a bridge or strategy to get across. In this method, participants were allowed to set their visions and their hopes for the Rupununi, its people and resources for the next 10 – 15 years. In the process of setting the vision, participants also discussed the current situation, so as to have a comprehensive overview on the current reality within the North Rupununi. This would help them understand from what situation they had to work to achieve their visions. The visions from each of the focus groups were discussed by the entire group and then through negotiation combined to develop one consolidated list of visions for the Rupununi for the next 10 – 15 years. From this consolidated list, the top five visions were selected by each group. The entire group met again to discuss the choices for the five high priority visions and to negotiate the importance of the visions selected by each group for the NRAMP project to present on behalf of the communities at a forum in Georgetown. Based on these negotiations six visions were chosen as the high priority visions. Each focus group was given two of the visions to collect further information and to eventually develop a logframe for implementation.

The following outlines how the visions were developed. A set of questions were used to probe and explore the issues in depth and spider diagrams were used to represent the views of the group. These were as follows:

What is the timeline for the vision? – in this case 10-15 years
What are your hopes for the future?
What kinds of activities would you like to see happen and would you like to do in the Rupununi?
Where would you like to conduct these activities – refer to the map of the core area?
Who would you want to be involved in these activities/events?
What resources would you hope to be able to use?
What level of use would you like to see?

Participants were encouraged to express their dreams or desires for the future without feeling held back by what was happening at the time, or by what others expected to happen. This was basically an opportunity to put all of peoples' dreams for the North Rupununi on the table, so that others could know of and provide an avenue for achieving mutual hopes.

The final six visions for developing actions plans were:

Improved agricultural (production and marketing) processes;
Improved natural resource management and natural resource use in villages;
Have a comprehensive monitoring and management system for CITES and other locally important species with government and NGO's agencies that will lead to better decision making and management systems;
Promotion of local culture (language and life style);
To improve the security within the North Rupununi;
To develop alternatives to, and reduce dependency on, natural resources;

Each group then used the pathway approach to explore the current situation for each goal, compare the present situation to the goal and then develop monitoring and evaluation action plans to reach the goal.

Scenarios can also take the form of alternative stories of how the environmental and economic situation within a region may develop. The scenarios described in Figure 4.1, for example, present four very different but plausible future realities that the communities of the North Rupununi may face. These scenarios are separated along two distinct axes. The first describes a continuum between a completely self sufficient community which is solely reliant only on natural resources, at one end of the axis. Whilst at the other end is complete dependency for food and income from outside the region. The second axis describes the situation between no land use change at one end and complete land use change at the other. Land use change could occur as a result of agricultural or industrial development, logging, climate change or natural disasters. A typical Traditional Lifestyle scenario is one of a village community relying on subsistence farming and hunting without contact with external markets or funding. The Large Scale Tertiary Activities scenario could be one where the entire community is involved in sustainable eco-tourism using the natural resource base as a visitor attraction. The community is completely reliant on external trade and does not farm or hunt resources from their immediate environment. The Large Scale Primary Production Activities scenario would describe a situation where large scale, commercial agriculture, logging, industry or mining has transformed the landscape. All members of the community would be employed by these commercial organizations and therefore would be solely reliant on external trade and commerce. The Post-environmental and/or Global Economic Crisis Scenario describes a situation after a major environmental change such as a hurricane or

climate change. This would result in a complete transformation of the traditional resource base but without external support and/or reliance. Alternatively a collapse in the global economy or external trade could also result in this scenario developing.

The first task to work through would be to explore the current viability (health) of the social and ecological systems i.e. by focusing on indicators of existence and ideal performance. Shifting from one scenario to another through conscious change or as a result of external factors will threaten the health of both social and ecological systems. If a community wants their social system and associated ecological system to remain within a scenario then the important system health property to manage is that of resistance. The indicators of resistance should be focused on because these elements will determine whether the system will shift or not. If gradual change occurs, such as slow climate change, or if the community wants to explore gradual change to another scenario by focusing on trade outside the region then the important system health property is flexibility. However, if rapid change is expected by living in an area prone to environmental disasters or if funding is in place to transform the local economy and type of livelihoods then the important system health property is adaptability.

When setting specific short-term or medium-term goals it is important to identify the current system viability, which scenario the community currently finds itself within and whether the management goal will result in a move towards another scenario. Box 4.2 outlines some examples of goal setting using scenario analysis.

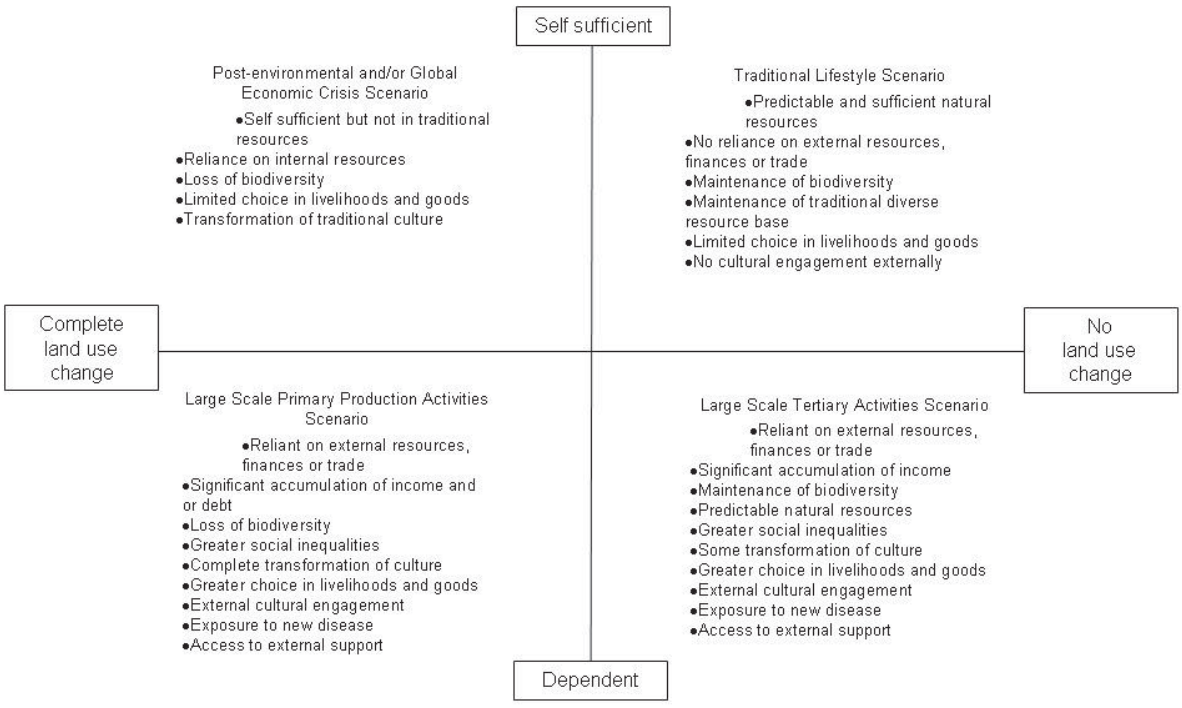


Figure 4.1 Four possible future scenarios for the North Rupununi

Box 4.2 Examples of goal setting within the North Rupununi using scenarios

A number of communities within the North Rupununi have adopted the NRAMP approach to assist in the management of natural resources. The communities met through village level meetings to identify specific issues that were concerning them. For example, one community was concerned with the falling numbers of Giant River Turtles and their ability to use turtle eggs as a source of food into the future, whilst another community sought to diversify income through ecotourism.

Once the issues had been identified it was important to develop a shared understanding of the context for decision making and to set goals for management through negotiation. They achieved this by understanding the current management scenario where they find themselves and where they want to end up. Understanding this allowed them to focus on the important system health properties for their particular situation and to develop realistic goals.

In the case of the Giant River Turtle project the community identified that ecological and social viability was being threatened, but that they wanted to remain within the Traditional Lifestyle Scenario. Therefore, the system health properties important when setting the goal and shaping management were existence, ideal performance and resistance. In this context, the goal set by the community was to maintain the long-term population of Giant River Turtle which would support their traditional lifestyle and supplement their diet through a sustainable turtle egg harvest. The community that wished to diversify their income through ecotourism identified that they would be moving from a Traditional Lifestyle Scenario to a Large Scale Tertiary Activities Scenario. Within this context the social system health properties of importance were existence, ideal performance and flexibility. However, since there was a wish to maintain the existing ecological system, the ecological health system properties of importance were existence, ideal performance and resistance. Once a shared understanding of the situation was reached the goal set by the community was to maximise income through ecotourism whilst maintaining current biodiversity. The community recognised that ultimately they did not want to move completely to a Large Scale Tertiary Activities Scenario and as such would try to ensure that transformation of their culture would be kept to a minimum.

4.3 Observing and re-observing activity

The three main categories of techniques for the observation phase are modelling, indicator selection and data collection. Models help simplify the situation in a way that makes it understandable by a range of stakeholders. This enables stakeholders to identify the appropriate group of indicators. A range of data collection techniques can then be used to compile the relevant information.

4.3.1 Using modelling techniques to understand community and wetland health

Although we may not immediately think of them as such, we regularly use models in everyday life in order to achieve even the most basic task. For example, maps and plans are models of the layout of the roads, rivers, buildings or other features of our physical environment. A house builder's sketch, or a car mechanic's engine drawing is a model of something which is to be constructed. Prior to construction, we may be shown a scale model of it in order to test our reactions, or to see how it might operate. Photographs are models of the scene that the camera user saw when the shutter was pressed. Sculptures or paintings are also models, in that they are representations of some aspect of the world as it is interpreted by their creators. The graphs and tables used to show annual fish catch are models of the expected catch of these resources, and at the national level, we are told that Government has a model of 'the economy' on which it bases decisions about tax rates, interest rates and other aspects of fiscal policy.

Before embarking on any data collection and to better assist the understanding of inter-relationships among social and ecological systems, a model should be developed. This will allow a more focused approach to developing appropriate indicators for specific management goals. At a fundamental level, all our interactions with the world around us depend on our internal, mental models of how we perceive that world. Models often used in natural resource management include:

1) Verbal models: ways in which we think and act are shaped by our conversations which describe a situation. As well as the way we individually picture situations in our minds, verbal models also include the different ways we express things through language. For example, the way someone from a city describes a wetland will be different to how someone from a rural, Amerindian community, describes a wetland. The most common way of presenting verbal models is through oral communication, but increasingly this is through the written word in books.
2) Visual models: these models can be represented in two-dimensional and three-dimensional forms. Three-dimensional visual models usually use some physical material to represent physical aspects of a situation, such as using clay to form a landscape such as mountains and lakes. Two-dimensional representations include photographs, maps and plans and other different sorts of two-dimensional diagrams such as flow diagrams and seasonal calendars.
3) Numerical (mathematical) models: these models can appear to be extremely powerful and sophisticated, and sometimes, 'modelling' is taken to imply only mathematical models. They make use of mathematical techniques to calculate numerical values for the properties of some aspects of the issue under consideration.

Initially a model should be developed to help all stakeholders understand the relationships among the social and ecological systems in relation to the agreed management goal. This can be achieved through undertaking a brainstorming session where all components of the situation are identified and then their relationships determined. To achieve identification of relationships within the situation a causal loop diagram could be developed. The basic building blocks of causal loop diagrams are components joined by an arrow in order to represent causal relationships. For example:

Increased fishing --> fish population reduction
Increased births --> population growth
Increased deforestation --> reduction in rainfall

The phrases usually describe an activity or process (eg. increased fishing) happening to a component of the social and/or ecological system. The arrow signals that the change in the left-hand side component or one of its attributes will result in a change in the right-hand side component or one of its attributes. The arrow is a symbolic representation of terms such as 'causes', 'affects' or 'influences'.

The causal loop diagrams are excellent at communicating feedback relationships. In some representations, the components can be shown to effect each other in a cyclical process as illustrated below:

Increased fishing effort -------> fish population reduction
Increased fishing effort <------- fish population reduction

In order to maintain some clarity in the diagram and not making it end up looking like a bowl of chow mein, it is useful to have the principal feedback loop at the centre of the diagram and limits to the number of causal links coming in. Seven components, plus or minus two, is a useful guideline in deciding how many variables to include. But this is only a guideline for the final diagram. The actual drawing would

benefit from various drafts, with each emphasising analysis (breaking down relationships into increasingly detailed components) and synthesis (combining components and attributes to better reflect the purpose of the diagramming activity). One could visualise this as alternating phases of sweeping in relevant detail, and then sweeping out irrelevant information.

In addition to the causal loop diagram you could also develop a spatial model by mapping the natural resources of interest within the region. This should be done by using a baseline map, such as a contour map, and a focus group and/or available information to provide the type of natural resources and their relative locations. If time and resources are available this map can be translated into a three-dimensional physical model using materials such as clay, balata and pigments

4.3.2 What are indicators?

Once a model of the management issue has been developed, a set of indicators need to be identified to help determine the health of the system in relation to the goal. Indicators can be used to simplify, quantify, analyse and communicate the health status of a particular aspect of the social-ecological system by depicting issues in less complex terms or in a single meaningful message.

For mechanical systems, the task of identifying indicators for systems performance is relatively simple. Take for example a car. On a car's dashboard, an information system presents all the key indicators of car performance: speed, engine revolutions per minute, fuel level, engine temperature, and various icons which light up if certain vital car components malfunction. We have significantly more difficulties in identifying indicators for the performance of living systems, such as organisms and societies. For most living systems, it is virtually impossible to have a comprehensive understanding of how the whole system works and behaves, and its consequent state. In an ideal world you would monitor all structures and processes within a living system (a bit like an engineer would design and evaluate every single aspect of a car), and then go on to identify key structures and processes which determine the viability of the system. These would then become your indicators of system performance. This is simply not possible with living systems. There are far too many structures and processes to monitor and these change and adapt with changing environmental conditions. In many cases, we are forced to significantly simplify our understanding of living systems, in other words, our models of these living systems do not reflect their actual complexity.

An example of a simplified set of indicators developed to check the viability of an extremely complex living system is the sequence of basic tests a doctor does the moment you walk into his or her surgery with a serious illness. They check your temperature, breathing, pulse and weight to height ratio. This will give the doctor immediate information on your viability. Further checks are then required to identify the cause of your ill-health according to a series of models they have attributing symptoms to diseases.

An indicator therefore identifies a measurable component, such as body weight/height ratio, or process, such as heartbeat, that can be used to describe the relative status of a particular aspect of a living system. An indicator is used to simplify, record, analyse and communicate the status of a particular aspect of a living system by depicting issues in less complex terms or in a single meaningful message. For example, body temperature of 40°C equals life-threatening viral or bacterial infection.

No single indicator can give a complete picture of a situation, and so indicators are more accurately defined as partial indicators. Indicators provide evidence that a certain condition exists or certain results have or have not been achieved. A good indicator alerts you to a problem before changes become irreversible and helps you recognise the areas to focus on in order to resolve the problem.

4.3.3 Techniques for determining indicators

To determine useful and measurable indicators of your management goal, the components of your model should be assessed against the following two main criteria groups (adapted from Reed *et al.*, 2006): measures of progress towards your goal; and user-friendliness. Each indicator should have the following characteristics if they are to provide a good measure of progress towards a goal:

- Be representative of system health properties, namely: existence; ideal performance; resistance; flexibility; and adaptability;
- Be accurate and bias free;
- Be reliable and consistent over space and time as some indicators will be specific to particular locations and time frames;
- Assess trends over time;
- Provide early warning of detrimental change;
- Provide timely information;
- Be scientifically robust and credible;
- Be verifiable and replicable;
- Sensitive to the level or rate of change of the model component/process of interest;
- Have a target level, baseline or threshold against which to measure them.

Although an indicator may be good at measuring progress towards the goal they will be useless if they do not also fulfil the following user-friendliness criteria:

- Accessible - easily measured given resource constraints;
- Affordable - make use of existing data where available or be cost effective and rapid to measure;
- Understandable - simplify complex phenomena and be clear and unambiguous, easy to understand and be able to be communicated by all stakeholders and decision makers;
- Relevant – developed by and meet the requirements of different end-users and can be directly linked to practical actions/outcomes.

Depending on the data source, indicators can either be quantitative or qualitative and used in combination. Model components/processes can be assessed for their suitability as indicators through a stakeholder workshop or determined by an expert-led approach. Whichever technique is used it is important that as many of the above criteria are met as possible. Box 4.3 gives examples of how indicators were chosen by North Rupununi community members for assessing the health of a particular waterbody and for the performance of a school.

Box 4.3 Examples of how indicators were chosen by North Rupununi community members for assessing the health of Devil Pond and for the performance of a school.

Indicators for the health of Devil Pond in the North Rupununi

The key characteristics of indicator i.e. need to be simple, measurable, time bound, and appropriate for the type of question you are trying to answer, were first explained to community members. The community members were then asked to do an outline that is representative of the shape of Devil Pond. They were then asked individually or as a group to fill in the various types of living forms that inhabit the pond and the area around the pond, including any special features and the different types of uses of the pond. After doing this, the community members were asked about what they would look for if they were to develop a monitoring programme to understand the health of the pond over time. As community members voiced suggestions on possible indicators, they were then asked to take those suggestions and discuss whether they met the criteria for setting indicators. Interestingly, as people engaged with the list of criteria, they became more argumentative within their groups of what would be a good indicator.

The most frequent indicator that was suggested for assessing the health of Devil Pond by community members was the presence of Giant Otters (P. brasiliensis), and whether they had dens and campsites at the pond. The justification for choosing this as an indicator was because the Giant Otter eats a lot of fish, and their presence at a location is a sign or signal that the fish population is healthy at that site. A healthy fish population in turn indicates that the ecological functioning of the pond is at a level where it can maintain fish populations. Another justification for the community members choosing this as an indicator was because to check on the Giant Otter's presence at the pond was relatively easy, and could be done without many resources.

Indicators for assessing the performance of a primary school

This example involved community members putting themselves in the role of an Education Officer based in Georgetown, who had to assess how a particular school was performing, and whether it was necessary for the school to continue operation. It was first explained that it was important that the indicators selected were appropriate given that the Education Officer was not based in the village and would not have first hand knowledge of how the school was performing. So what must this Education Officer look for to be able to deliver a factual assessment to the Minister on how well the school is performing? Indicators that were identified by community members included looking at the levels of enrolment and how those levels changed every year over the last 5 years. Another indicator that was suggested was looking at the annual number of students that passed the Secondary School Entrance Examinations to be eligible to attend high school. By collecting this kind of data, the Education Officer could then be able to make or recommend actions by analysing the data.

4.3.3.1 Indicators developed for the North Rupununi

A number of social and ecological indicators were developed for the North Rupununi wetlands in terms of the system health properties outlined in the *Goal-setting and re-setting* section:

1) Community health indicators - these indicators are a guide for assessing community health and are listed in Table 4.1. It is important that the person carrying out the assessment reviews the appropriateness of these indicators to the particular situation being assessed. It is also important that the assessor is open to including other indicators which may become apparent before or during the data collection. In addition, it will be important to know what priority is given to certain indicators. Ranking can be carried out prior to or together with data collection to assess how important indicators are considered to be, within each health category (see *Techniques for measuring indicators* section for ranking methods). This ranking can then be used to assign weights to final index calculation (see the *Evaluating and re-evaluating the situation* section).
2) Wetland health indicators – these indicators are given in Table 4.3. Unlike the social indicators, these indicators have already been tested during the first phase of the Darwin project, and are therefore considered as appropriate indicators of wetland health. However, the assessor must be open to including other indicators which may become apparent before or during the data collection.

4.3.4 Techniques for measuring indicators

There are a number of techniques that can be used to investigate typical social and ecological components that are often used as indicators in the context of natural resource management associated with wetland ecosystems and indigenous communities. The North Rupununi Wetlands Monitoring Manual (2006) outlines many of these techniques:

1) Ecological system monitoring – this gives detailed descriptions of how to measure geomorphological, hydrological, biological and land use indicators associated with wetlands;
2) Social system monitoring – this gives detailed descriptions of how to gather social indicator information through a variety of methods including interviewing, visualisation and diagramming and ranking and scoring. Table 4.2 gives an example of how interview questions could be developed to address the various indicators listed in Table 4.1. The response categories are examples of how the data collected through interviews and/or focus groups could then be categorised for further interpretation and assessment if necessary (see *Evaluating and re-evaluating the situation* section)

In a location such as the North Rupununi and Guyana in general, where technical and human resources may be limiting, and environmental conditions can be challenging, it is important to make sure that the appropriate techniques for measuring indicators are chosen and that the sampling strategy is realistic in terms of access to sites/locations. At the same time, it is important to remember that the significance of the results will depend on the sampling used in space and time. For example, if interview questions are answered through a single source, for example secondary sources, or perhaps just through interviewing one person, the results will not be as reliable as if these questions had been answered by a whole community. The same would apply to measuring the wetland indicators only in one or two waterbodies. Also, if questions are answered in one timeframe or wetland biophysical data at one time of the year, results may not reflect temporal variations in the aspects of many of the indicators. It is therefore important to make it very clear from where/whom and when the data was collected.

Table 4.1 Community health indicators developed for the North Rupununi wetlands. Health categories are described in *System health properties* section. Techniques are described in the *Techniques for measuring indicators* section and the North Rupununi Monitoring Manual (2006), where I = Interviewing, D&V = Diagramming and visualisation and R&S = Ranking and Scoring.

Health category	Indicator code	Indicator category	Measurable indicator	Technique	Assumptions
Existence	A1	Availability of shelter	Condition of housing per household	I, Observations	Factors such as poor ventilation, lack of protection from extreme weather conditions and disease vectors (e.g. mosquitoes), and inadequate sanitation significantly affect the health of individuals, especially the elderly and children.
	A2	Availability of food	Food shortage over 1 month	I, D&V	Inadequate levels of food consumption can result in stunted growth, muscular problems fatigue and reduced resistance to infectious diseases.
	A3	Availability of water	Access to clean drinking water per household e.g. well, river, rainwater	I, D&V	Different sources of water are associated with varying risks with regards to infectious diseases. In general, rainwater collected in a sterilised container is the safest for consumption while open water especially in stagnant conditions is the least safe.
	A4	Health status	Number of days sick per month per household	I, D&V	Presence of infectious diseases within at least one individual within a household has the potential to threaten the health of other household members. Illness reduces capacity of household.

Ideal performance	B1	Efficiency of income generation and/or resource production/ extraction with respect to the amount of work that is carried out	Amount of free-time per week per household	I, D&V	The optimum hours worked per week should not exceed a certain threshold which would take away from other social activities such as family life and community support.
	B2	Child labour	Amount of support needed from children aged 16 and below per household to meet subsistence needs	I, D&V	A healthy childhood should be comprised of learning and playing activities. Subsistence work can be considered as learning as long as other learning and playing opportunities are not impaired.
	B3	Subjective well-being	How happy people feel	I, D&V	The happier people are feeling, the healthier the community.
	B4	Overall community health	Proportion of community members greater than 60 years old	I, D&V	The higher the life expectancy in communities, the better they are performing.
	B5	Participation in decision-making	Mode of decision-making in community	I	Decision-making through participation will lead to a more effective community.
Resistance	C1	Level of community cohesion and support	Participation in community events	I, D&V	Participation in community events strengthens level of community cohesion.
	C2	Level of crime	Occurrence of thefts per village per year	I, D&V	Greater community cohesion and support could lead to lower levels of crime.
	C3	Level of conflict	Occurrence of violent incidents per year	I	Greater community cohesion and support could lead to lower levels of violent incidents.
	C4	Rights and access to land and resources	Level of legal rights and access to resources	I, D&V, GIS analysis	Land tenure reduces the influence and impact of external pressures.
	C5	Availability of capital assets	Quantity of capital assets per household e.g. cattle, bicycle, boat, motorcycle, gun, chainsaw, generator	I	Capital assets can help to buffer households from internal and external pressures.

	C6	Availability of community infrastructure	Quantity of community infrastructure e.g. school, church, clinic, meeting hall, sports facility, access road	I	Community assets can help to buffer communities from internal and external pressures.
	C7	Traditional knowledge and practices	Role of traditional practices in household	I	Ability to carry out traditional practices allows communities greater independence from external pressures.
	C8	Resource governance	Strength of community implementation of resource use controls	I	Traditional controls have been historically effective means of controlling over-exploitation of natural resources and disturbance both by community and non-community members.
Flexibility	D1	Diversity of traditional resources	Diversity of local natural resources used per household e.g. fish species, traditional crop species and varieties, traditional non-timber products etc.	I, D&V	A high diversity of resources allows communities to withstand minor changes.
	D2	Diversity of traditional livelihoods	Number of traditional livelihood activities undertaken per household e.g. traditional fishing, hunting	I, D&V	A high diversity of livelihood activities allows communities to withstand minor changes.
	D3	Level of access to facilitating technologies	Number of facilitating technologies with household access e.g. solar panels, boat engines, cassava grater, motorcycle, chainsaw, seine nets	I, D&V	Access to facilitating technologies allows communities to withstand minor changes.

Adaptability	E1	Level of education	Highest level of formal education per household	I	Educated individuals are able to bring a wide range of skills and knowledge to help devise new ways of adaptation to changes.
	E2	Significance of non-traditional resources	Significance of non-traditional natural resources used per household i.e. a resource not used by previous generation e.g. introduced cattle, introduced crop species and varieties etc.	I, D&V	A high presence of non-traditional resources allows communities to change exploitation patterns.
	E3	Significance of non-traditional livelihoods	Significance of non-traditional livelihood activities undertaken per household in village i.e. a livelihood not undertaken by previous generation e.g. service sector jobs, NGO jobs, retail, commercial activities	I, D&V	A high presence of non-traditional livelihood activities allows communities to respond to changes in circumstances.
	E4	Participation in activities outside community	Proportion of household adults having participated or currently participated in activities outside community e.g. working in projects, NGOs, Lethem, GT, Brazil	I	Living and working outside your own community can provide experiences that could help adapt to future change.
	E5	Level of access to information	Time spent per household accessing information e.g. radio, newsletters, internet	I	The greater the access to different forms of information, the more knowledgeable people are to actual and potential changes in their surroundings, thereby giving people opportunities to change behaviours.

Table 4.2 An interview or focus group checklist to help collect indicator data

Theme of questioning	Specific questions	Response categories	Notes	Indicator code
What house do you live in?	What is the condition of the housing?	1 = exposed to elements e.g. rain and wind 2 = not exposed to elements but badly ventilated and overcrowded 3 = secure and spacious	Observations could be made to collect this data	A1
What is the makeup of the household?	How much free time do you have a week e.g. to attend church, community events, visit family etc?	1 = very little time 3 = enough time	Take individual scores and average for household	B1
	What is the highest level of formal education in the household?	1 = did not complete secondary school 2 = completed secondary school 3 = further education post secondary school		E1
	How much time do you spend per household accessing information?	1 = less than one hour/week 2 = two to six hours/ week 3 = greater than six hours/week		E5
	How much support is needed from household children (aged 16 and under) to sustain household needs?	1 = high 2 = medium 3 = low	Take individual scores and average for household Record ages of all children	B2
	What proportion of the community are older than 60 years?	1 = less than 10% 2 = between 10-20% 3 = greater than 20%		B4

	How many household adults have participated or are currently participating in activities outside the community e.g. working in projects, NGOs, Lethem, GT, Brazil?	1 = none 2 = some 3 = all		E4
	On average, how many days per month are members of household sick?	1 = most days 2 = occasionally 3 = rarely	Take individual scores and average for household	A4
	How happy are people in your household?	1 = unhappy and depressed 2 = so and so 3 = happy	Take individual scores and average for household	B3
What kind of resources do you use?	Where do you get your drinking water mainly from?	1 = surface water e.g. river 2 = well 3 = rainwater	If 1 or 2 are boiled, then give value of 3	A3
	On average, how many days per month is the household short of food?	1 = most days 2 = occasionally 3 = never	Use seasonal calendars to see intake through the year	A2
	How often does the household practice any of the following traditional activities: natural resource extraction, traditional medicine, spiritual practices, use of local language?	1 = rarely practiced 2 = occasionally practiced 3 = frequently practiced		C7
	How diverse are local traditional livelihoods in the household?	1 = low 2 = medium 3 = high		D2
	How diverse is local resource use in the household?	1 = low 2 = medium 3 = high		D1
	What level of rights and access do you have to all the resources that you need?	1 = few or no rights and access 2 = partial rights and access 3 = rights and access to all resources	Mapping can help identify areas	C4

	What is the level of community implementation of natural resource controls?	1 = low 2 = medium 3 = high		C8
	How important to your livelihood are non-traditional natural resources i.e. a resource not used by previous generation e.g. introduced cattle, introduced crop species and varieties etc?	1 = not important 3 = important		
	How important to your livelihood are non-traditional livelihood activities undertaken i.e. a livelihood not undertaken by previous generation e.g. service sector jobs, NGO jobs, retail, commercial activities?	1 = not important 3 = important		
	What quantity of capital assets do you have e.g. cattle, bicycle, boat, motorcycle, gun, chainsaw, generator?	1 = low (less than three) 2 = medium (three to five) 3 = high (greater than five)		C5
	Which of the following do you have access to: solar panels, boat engines, cassava grater, motorcycle, chainsaw, seine nets?	1 = low (less than three) 2 = medium (three to five) 3 = high (greater than five)		D3
What kind of decision-making takes place?	Overall, how do you think decisions are arrived at within your community?	1 = little or no consultation on decisions 3 = decisions arrived at in consensual way		C1.1
	On average, how often during a week do you participate in community events and activities which do not only include your family?	1 = rarely, less than once 2 = one to two times 3 = greater than two times		C1
	What is the occurrence of thefts per village per year?	1 = occasional 2 = rare 3 = never		C2

	What is the occurrence of violent incidents per village per year?	1 = occasional 2 = rare 3 = never		C3
	What quantity of infrastructure does the community have e.g. e.g. school, church, clinic, meeting hall, sports facility, access road?	1 = low (less than three) 2 = medium (three to four) 3 = high (greater than four)		C6

4.3 Evaluating and re-evaluating the situation

Evaluation, in the context of NRAMP, occurs in two distinct assessment stages. Firstly it is used to assess and judge the value of the indicators in relation to system health properties and the management goal. This assessment involves the setting and re-setting of thresholds for indicators to ensure they are appropriate. Secondly, the purpose of the evaluation is to help reflect on what extent the management goal is being achieved and identifying required changes. This is achieved by evaluating the individual indicator performances in relation to the important system health properties for each management goal.

The following sections describe how these two differing evaluation stages can be achieved. Firstly, techniques for threshold setting and evaluation of community and then wetland health indicators are described. Secondly, the technique for evaluating the progress towards a management goal is outlined.

4.3.1 Data verification

It is important to develop a database to store information being collected. This should be designed in such a way that it is easy to analyse the data later on, and significant manipulation of the raw data is avoided. Common software packages such as Microsoft Excel can be used to create simple databases. When data is inputted into a database, mistakes can be made which could have significant impacts on later analyses. It is important therefore to manually check each file record against field notes after data has been inputted. It is important to get someone else, i.e. not the data imputer, to undertake this task as double verification means that mistakes can be more easily identified.

The data then needs to be checked for anomalies. For ecological data, the best way to do this is to graph different characteristics/variables for each site. For example, by plotting water depth against month for a site it is possible to quickly identify errors in the data inputting. Once this is done, you are then left with a matrix of missing data to which imputation methods can be applied. For social data, a process of triangulation i.e. getting at least three sources to confirm the anomaly, can be used.

4.3.2 Missing data

It is often the case that during any monitoring programme, data is not recorded for either one or a few variables. It may be that sites were inaccessible, or that the vehicle broke down or that equipment was not working properly. Whatever the reason, the non-recording leaves a gap in the database, so that when it comes to analysing the data, there are problems. How can we deal with missing or incomplete data?

When you choose a missing data handling approach, termed imputation, keep in mind that one of the desired outcomes is maintaining (or approximating as closely as possible) the shape of the original distribution of

responses. Although there are numerous imputation methods, the following outlines some of the more user-friendly for non statisticians which can be done using common software packages such as Microsoft Excel:

Whole record data deletion: If a record has too many missing data, for example a whole array of variables in one monitoring month, then it is necessary to omit that entire record from the analysis.

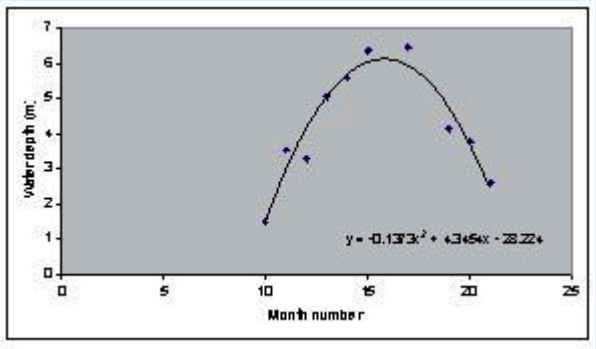
Mean substitution: If there are no discernible patterns in the variable or a linear increase/decrease in the variable over time, then a variable's mean value computed from the available records can be used to fill in missing data values.

Regression method: For some variables there may be a distinct pattern or distribution. For example, water depth in the North Rupununi shows a polynomial pattern as a result of the seasonal flooding that takes place. As such a regression equation can be constructed for the variable using the records available (see Box 4.4). The X values are then inputted into the equation to calculate the Y values that 'fit' the equation. This also involves calculating the missing data Y values.

Traditional knowledge: In some cases, a missing value could be found by asking a local. For example, if one month black caiman are not recorded, it would be possible to use traditional knowledge of local inhabitants and/or site users to find an estimate of the black caiman numbers during that month. Making sure that this information is gathered from at least three people ensures that the estimate is reliable.

Box 4.4 The water depth values are plotted and a polynomial of order two is fit to the data points. The resulting regression equation, displayed on the graph, is used to calculate a new set of Y values, including the missing data points (shown in bold). All calculations carried out using Microsoft Excel.

Date of Survey	Month Number	Water Depth (m)	Fit
Jan 05	10	1.5	1.5
Feb 05	11	3.52	2.9621
Mar 05	12	3.3	4.1496
Apr 05	13	5.05	5.0625
May 05	14	5.6	5.7008
June 05	15	6.35	6.0645
July 05	16		**6.1536**
Aug 05	17	6.45	5.9681
Sept 05	18		**5.508**
Oct 05	19	4.14	4.7733
Nov 05	20	3.8	3.764
Dec 05	21	2.6	2.4801



After the missing data point(s) have been imputated, it may be necessary to test how sensitive they are. For example, in the regression method outlined above, the square root of the sum of the residuals ('fit' data minus actual data) squared can be used to calculate how much we can allow the new 'imputated' value to vary when carrying out any sensitivity analysis (see Box 4.5) The imputated value is then adjusted by this amount to see how much effect varying the imputated value can have on later statistics. If varying the imputated value has a large effect on later statistics, it is not reliable and would need to be recalculated.

Box 4.5 The square root of the sum of the residuals ('fit' data minus actual data) squared can be used to calculate how much we can allow the new 'imputated' value to vary when carrying out any sensitivity analysis. In the example below this is 0.384. Varying the two imputated values by this amount in further analysis will allow us to decide on the reliability of the imputated values. All calculations carried out using Microsoft Excel.

Date of survey	**Month number**	**Water depth (m)**	**Fit**	**Residuals**	**Res squared**	
Jan-05	10	1.5	1.5	7.11E-15	5.05E-29	
Feb-05	11	3.52	2.962	0.558	0.311	
Mar-05	12	3.3	4.150	-0.850	0.722	
Apr-05	13	5.05	5.063	-0.013	0.000	
May-05	14	5.6	5.701	-0.101	0.010	
Jun-05	15	6.35	6.065	0.286	0.082	
Jul-05	16		6.154	0	0	
Aug-05	17	6.45	5.968	0.482	0.232	
Sep-05	18		5.508	0	0	
Oct-05	19	4.14	4.773	-0.633	0.401	
Nov-05	20	3.8	3.764	0.036	0.001	
Dec-05	21	2.6	2.480	0.120	0.014	
					1.774	**sum**
					0.148	**sum/n**
					0.384	**sqrt(sum/n)**

4.3.3 Analysis to set community indicators thresholds

4.3.3.1 Analysing social data

The first step is to organise the data, which may involve transcribing audio tapes, putting together background information, revising notes taken during interviews, and making sure diagrams are linked to interview notes. The next step is to analyse the date using coding. There are several ways to do this:

1) you can label the observer notes and quotes from transcripts with the question number(s) from the interview guide to which the note or response pertains. See Table 4.2 for example of response categories for different questions related to indicators.
2) you can look for themes, trends or ideas in the data which may or may not coincide with the questions asked. You can develop a simple code (coloured brackets or abbreviations) for each theme. Write the code next to each note or response which echoes the particular theme.

When coding data it is important to note the following:

1) there are a number of ways any set of data can be organized. The challenge is to come up with the most useful approach, considering your purpose and the people to whom you are reporting the data;
2) do not create too many codes or your data will be confusing;
3) the appropriate code is not always obvious. It is critical to challenge your assumptions and those of colleagues assisting you by discussing classification of data, particularly where a certain classification would confirm your assumptions;
4) data that do not relate to a discussion question or discussion theme do not need to be classified;
5) whichever classification system you use, keep an eye out for quotes suitable for the relevant outputs e.g. reports.

Once you have coded the data, you can then interpret the information. This involves making an explicit link between the coded data and the interview objectives and assumptions. To do this, develop a framework to relate the categories of data to one another (adapted from Krueger, 1994):

- 'What was known and then confirmed or challenged' by the interview data?
- 'What was suspected and then confirmed or challenged' by the interview data?
- 'What was new that wasn't previously suspected?'

When answering these questions, it is critical to:

- Be open to alternative explanations about the data, particularly if the data confirms your assumptions.
- Accept whatever the data reveal, even if it is discomfiting to the institution/person sponsoring the interview or clashes with your original research assumptions.

Other ways of analysing data will be through simple graphing and diagrammatical representation. For example, wealth ranking results can be used to develop simple histograms or pie charts. Many of the diagrams and/or parts of diagrams can also be coded in a similar manner as has been described above.

4.3.3.2 Setting thresholds for social data

Once data has been analysed, thresholds can be set for community viability. However, thresholds are heavily reliant on the values, norms and beliefs of people. For example, what are the acceptable levels of nutrition in the North Rupununi or what is the acceptable proportion of time spent being ill with malaria? Therefore, if the data being collected is baseline data, some community discussion and consultation must take place to:

a) decide which indicators are of significance i.e. ranking and prioritising indicators, and
b) to decide the thresholds levels for each indicator.

In some circumstances, this consultation may be widened to involve a range of stakeholders. In all cases, the analysed data should be presented to the stakeholders and used to facilitate threshold setting.

Thresholds and levels of indicators can be quantitative i.e. actual amounts or numbers, or qualitative, i.e. values such as 'good', 'bad', 'low' or 'high'. See, for example, the various thresholds have been set for the North Rupununi community indicators (Table 4.2). Other sources that could be used to support evaluation and setting of thresholds could be published statistics, national and international level sustainability indicator thresholds and research findings.

4.3.4 Analysis to set wetland indicator thresholds

4.3.4.1 Analysing ecological data

The first form of data analysis should involve graphing. Plotting monitoring data over time can help to deduce patterns and trends in the data. For example, environmental variables such as water depth may be plotted over time, and species data such as bird counts or caiman numbers can also be plotted over time. Some data, such as the birds, could be classified into groups such as families or feeding types and then plotted over time. Another useful type of graphing is to compare sites. So, for example, data on birds, whether it be particular species or groups, can be plotted by site, to identify any major differences.

From an initial graphing analysis and through secondary sources of information and individual knowledge, it is important to decide on what variables may be affecting species at different scales. For example, some variables such as surrounding vegetation types or waterbody type could have an important affect on bird species or caiman numbers at larger scales i.e. landscape scale, but at the local scale, other variables such as bank substrate or habitat niches will be significant. Once this is done, the species data can be analysed using multivariate analyses. There are many forms of multivariate data analyses for ecological data and before setting out, reference should be made to the literature. Some useful texts are the following:

Kent, M. and Coker, P. (1995). *Vegetation Description and Analysis: A Practical Approach*. John Wiley & Sons.

Lepš, J and Šmilauer, P. (2003). *Multivariate Analysis of Ecological Data using CANOCO*. Cambridge University Press.

For analysing multiple species and multiple environmental variables, and to look for relationships between them, Detrended Correspondence Analysis (DCA) and Canonical Correspondence Analysis (CCA) are useful techniques. This method could be applied for example to bird species monitoring data, where numbers of species are recorded at different sites and/or times and at the same time a number of environmental variables are also recorded. If there is only one species and multiple environmental variables recorded, then correlations between the species and environmental factors can be performed. This method could be used, for example, with caiman numbers and different environmental variables.

4.3.4.2 Setting thresholds for ecological data

Analysing the data and characterising trends and patterns in the data will help to establish thresholds for each indicator of wetland viability. For example, establishing the seasonal distribution and numbers of particular bird species, which may be indicative of certain habitat conditions, can form the foundation of baseline information and threshold setting. Once thresholds have been set for all the indicators, further monitoring and data analyses can use these thresholds to compare changing situations. Thus, the maintenance of threshold levels would signify that the wetland was within the category of 'healthy' or 'viable', but movement away from thresholds would signify that further detailed monitoring and analyses was necessary to ascertain the degree to which the wetland had changed and the possible factors contributing to this change. For example, if thresholds were set for the Egret as an indicator bird species for pond health in the form of minimum

numbers present in dry and wet season, and if numbers dropped below the minimum threshold in the following year, then this would signal that the wetland may be undergoing some form of negative change and so further investigations into the viability of the pond would be necessary.

4.3.5 Evaluating progress towards management goal

The development of a management goal and corresponding scenario model will indicate the system health properties of importance. For each system health property a set of indicators have been developed. These are then assessed to determine whether the management goal is being achieved or not. This assessment is achieved by examining the community health indicators and wetland health indicators for each system health property and combining the assessments in relation to the management goal. The indicators developed may exhibit different levels of control over a particular system health property or may work in combination with others. To take account of this, an assessment approach is required that either treats all indicators as equal, ranks their relative importance or uses them in combination to provide a result. The relative importance of indicators should be determined by consultation with stakeholders or use of an expert group.

For all wetland and community systems the system health property of *'existence'* is vital. Therefore within any management goal it is important that the indicators of this system health property are maintained. The following example looks at the indicators and how they could be combined to provide an assessment of wetland health.

The indicators of the system health property **'***existence'***,** for a wetland, can fall into the following groups: the availability of suitable physical characteristics; the availability of suitable ecological characteristics; and the availability of nutrients. Within each indicator group, a set of measurable indicators, such as presence or absence of required landform types and hydrological inputs for the *'availability of suitable physical characteristics'* indicator group have been developed. In this example, the presence of a required landform type, such as a permanent pond, and the presence of a required hydrological input, such as groundwater discharge, is of equal importance. Without one of the required landform types or equally without one of the required hydrological inputs the wetland system would no longer exist. Therefore within a wetland health assessment these two indicators would be scored the same. Equally if certain ecological characteristics or nutrients were not present the wetland system would not exist. Therefore, with these indicator groups the threshold is simply whether the indicators are present or not. Within the assessment for the system health property *'existence'* all indicator groups would be equal and require a positive result for the system viability to be maintained.

4.3.6 Evaluation of the North Rupununi social-ecological wetland system

The following sections provide examples of how evaluation could be and have been undertaken within the North Rupununi. To date, data has been collected for the wetland health assessment and analysed so that the system health properties can be used to evaluate management goals. Data gathering is not currently complete for the community health indicators so an evaluation of the social system health properties has not yet been undertaken within the North Rupununi

4.3.6.1 Community health assessment

Calculating a health index

In order to do the overall assessment of community health, an index can be developed for each health category. First we need to look at the actual scores for each indicator and the ranking of the indicators within each health category. So, for example, for existence, the average values for the four indicators and their ranking, in brackets, may be as follows:

Housing = 2.7 (1)
Food shortage = 1.75 (4)
Availability of clean water = 2.3 (3)
Health status = 1.2 (2)

The new values for these indicators are found by multiplying the average indicator values by the weighting, as follows:

Housing = 2.7
Food shortage = 7
Availability of clean water = 6.9
Health status = 2.4

In the North Rupununi community indicators, most indicators have a value from 1 to 3. If the values are added up, the maximum is 12 and the minimum 4. However, with the weights, these maximum and minimum values change, as follows:

Housing = weight = 1, therefore min value is 1, max 3
Food shortage = weight = 4, therefore min value is 4, max 12
Availability of clean water = weight = 3, therefore min value is 3, max 9
Health status = weight = 2, therefore min value is 2, max 6

If we add up all the new minimum and maximum values, we get a minimum of 10 and a maximum of 30.

The following formula is then used for normalising the final values (i.e. fitting them between 0 and 1): (total weighted indicator value - minimum weighted value)/(maximum weighted value - minimum weighted value)

In our example, this would be:

(2.7+7+6.9+2.4 - 10)/(30 - 10) = 0.45

In other words, a health index for existence would be 0.45.

The same procedure can be carried out for all the health categories.

Presenting the results to stakeholders

Once the indices have been calculated, they can be presented to stakeholders in various ways. For example, through graphs of the index values, or diagrams such as the radar diagram (Figure 4.2).

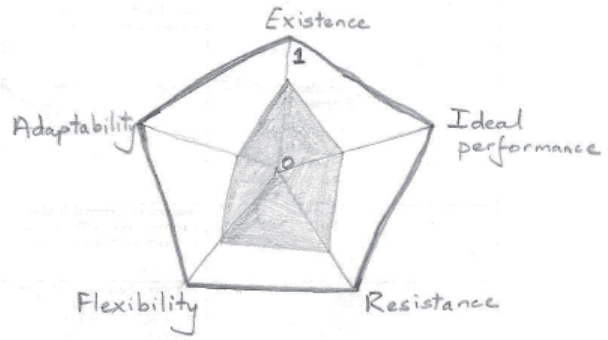


Figure 4.2 Example of a radar diagram. Each point on the radar diagram represents one of the health categories, and the shaded area represents the results of the data. Note that the scale on the radar diagram can be various divisions between 0 and 1.

An indication of the data quality should also be presented i.e. how reliable are the results in terms of how the data was collected.

The importance of the assessment is that it allows us to identify the key health categories in which a) further more detailed investigation is necessary and/or b) action needs to be taken.

4.3.6.2 Wetland health assessment

Table 4.3 allows an assessment to be undertaken to inform the 'health' or viability of a wetland system. The system health property of *Existence* is assessed by determining the availability of suitable physical characteristics, ecological characteristics and nutrients within the wetland. The assessment for this system health property determines whether the waterbody being assessed is existing as a wetland system or not. Although a wetland may be existing it is only performing well if species productivity and expected system functions are being performed at an optimal level. *Ideal Performance* is assessed using the indicators of: plant productivity; age structure of species; floodwater detention function; groundwater recharge function; groundwater discharge function; sediment retention function; nutrient retention function; nutrient export function; and in situ carbon retention function.

As discussed in earlier sections, when conditions change outside the wetland system the maintenance of existence and ideal performance requires the additional system health properties of resistance, flexibility and adaptability. *Resistance* is assessed using the indicator of species abundance. Large numbers of a particular species are important in maintaining the current nature of the wetland system even with changing conditions as individuals can be lost without impacting on the ability of the species to reproduce. *Flexibility* is assessed through the indicators of hydrological diversity, ecological diversity and diversity of habitat niches. High diversity of species and physical processes allows a wetland system to accommodate change using existing resources. Even if some species or physical processes are lost, due to high diversity the wetland system as a whole can still operate as other species and processes can fulfil the roles of the lost species and processes. *Adaptability* is assessed through the indicators of physical and ecological transport mechanisms and surrounding plant species availability. If ecological transport mechanisms are operating and if there is a source of species outside the wetland system then the wetland can adapt to changing conditions through plant and animal species being brought in to replace any species lost as a result of the changing conditions.

Table 4.3 Assessment procedure for wetland health. The method code refers to the recording sheet discussed within the North Rupununi Monitoring Manual (2006).

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
Existence	1a	Availability of suitable physical characteristics	Type of water input	Does the waterbody have hydrological inputs from one or more of the following: Groundwater discharge Surface runoff Surface overbank inundation from a river Surface overbank inundation from a rise in water level of a waterbody Precipitation and has flooding been recorded as water present at any point during the year?	C1, C2, C3, C4 or C5 and C7	For a wetland system to exist it requires hydrological inputs that exceed or equal the hydrological outputs
	1b		Landform	Does the waterbody have one of the following landform types? Main River Channel Creek Cut-off channel (inlet with connection to river) Former channel (separate from river) Ox-bow lake (separate from river) Permanent Pond Pond that dries out	B1, B2, B3, B4, B5, B6, B7, B8, or B9	An enclosed or open concave landform is required to retain the water
	2a	Availability of suitable ecological characteristics	Habitat type	Does the waterbody have one of the following habitat types around it? Forest - Flooded Forest - Non-flooded Savanna - Flooded Savanna – Non-flooded	E1, E2, E3 or E4	Water and landform are not enough for the system to exist it also requires plants and animals

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	2b		Indicator species	Have more than one of the bank and waterbody vegetation types been recorded at the waterbody? Bryophytes (mosses) Short herbs/creeping grasses Tall herbs/grasses Shrubs Climbers Trees and saplings Algae Floating Emergent Submerged	E22, E23, E24, E25, E26, E27, E28, E29, E30, and E31	
	2c			Was an individual recorded from the bird, caiman, Giant River Otter or incidental faunal surveys?	Bird, Caiman, Otter and incidental faunal surveys	
	3a	Availability of nutrients	Type of water	Does the waterbody have hydrological inputs from one or more of the following: Groundwater discharge Surface runoff Surface overbank inundation from a river Surface overbank inundation from a rise in water level of a waterbody	C1, C2, C3, or C4	Particular water inputs are mechanisms for transporting nutrients. Nutrients are required for the system to exist.
	3b		Type of soil	Is the bank material described as one of the following? Earth Sticky clay	D21 or D22	Certain soil types provide nutrients to the system

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	3c		Type of substrate cover	Is the bottom substrate described as one of the following? Silt/mud Clay Peat	D29, D30 or D31	Certain soil types provide nutrients to the system
The wetland system is in existence if there is a positive response to all of the following indicators: 1a, 1b, 2a, 2b and 2c and at least one of the following indicators: 3a, 3b or 3c.						
The wetland system is not in existence if there is a negative response to one of the following indicators: 1a, 1b, 2a, 2b and 2c or all of the following indicators: 3a, 3b or 3c.						
Ideal performance	1a	Plant productivity	Vegetation structure	Is one or more of the following waterbody features and habitat characteristics present? Vegetated bank base (bank feature) Vegetated mid-channel bar (bottom feature) Mature island (bottom feature) Areas completely covered in vegetation (bottom feature) Semi-continuous (Extent of trees and associated features) Continuous (Extent of trees and associated features)	D15, D36, D37, D38, E14 or E15	For plant productivity to be high there needs to be large areas covered with vegetation
	1b		Water nutrient status	Is the water colour one of the following? White Brown	C10 or C12	It is important for plant productivity that nutrients are available

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	1c		Agriculture and industry	Are all of the following land uses that potentially could take place within the waterbody or within 50m of the top of the bank absent from the area? Farming – Slash/burn without pesticide Farming – Slash/burn with pesticide Farming – Ranching Mining – Riverbed Mining – Land Settlement Burning Logging – Commercial Brick making	F3, F4, F5, F6, F9, F10, F17, F18, F19 or F26	Natural plant productivity will be low if human activity has removed or altered the natural plant community structure
	2a	Age structure of species	Bird survey	Have young, juveniles and adults been recorded for breeding species at the waterbody?	Bird survey	Individuals from different age profiles indicates a healthy breeding population
	2b		Caiman survey	Have hatchlings, juveniles and adults been recorded at the waterbody?	Caiman survey	
	3a	Floodwater detention function	Hydrological connection	Does the waterbody have hydrological inputs from either? Surface runoff Surface overbank inundation from a river	C2 or C3	Floodwater detention can only occur if the waterbody receives a water input from a river or slope.
	3b		Landform	Is the waterbody one of the following geomorphic types? Former channel (separate from river) Ox-bow lake (separate from river) Permanent Pond Pond that dries out	B6, B7, B8 or B9	Floodwater detention can only occur if the landform can trap the water

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	3c		Vegetation structure	Are one or more of the following bank vegetation types present >33%? Tall herbs/grasses Shrubs Trees and saplings	E24, E25, E27	Vegetation structure that can slow or trap water improves the floodwater detention ability
	3	This function is performed to a high degree if indicator 3a, 3b and 3c have a positive response				
		This function is being performed if only indicator 3a and 3b have a positive response				
		This function is not being performed if either indicator 3a and 3b have a negative response				
	4a	Groundwater recharge function	Hydrological connection	Does the waterbody have hydrological inputs from either? Surface runoff Surface overbank inundation from a river	C2 or C3	For the function to occur a water source is needed
	4b		Landform	Is the waterbody one of the following geomorphic types? Former channel (separate from river) Ox-bow lake (separate from river) Permanent Pond Pond that dries out	B6, B7, B8 or B9	For the function to occur the landform needs to be able to trap water
	4c		Soil	Does the waterbody substrate consist of one of the following? Gravel/pebble Sand	D27 or D28	The substrate needs to allow water to infiltrate into it for the function to occur
	4	This function is performed if indicator 4a, 4b and 4c have a positive response				
		This function is not being performed if either indicator 4a, 4b and 4c have a negative response				
	5a	Groundwater discharge function	Hydrological connection	Does the waterbody have hydrological inputs from? Groundwater discharge	C1	Groundwater discharge needs to occur within the waterbody for this function to occur

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	5b		Soil	Does the waterbody substrate consist of one of the following? Gravel/pebble Sand	D27 or D28	The substrate needs to be permeable to let the water flow up through it
	5	This function is performed if indicator 5a and 5b have a positive response				
		This function is not being performed if indicator 5a or 5b has a negative response				
	6a	Sediment retention function	Hydrological connection	Does the waterbody have hydrological inputs from either? Surface runoff Surface overbank inundation from a river	C2 or C3	For this function to occur sediment needs to be brought in from one of these water flows
	6b		Sediment load	Is the water colour one of the following? White Brown	C10 or C12	The water colour indicates that sediment is being carried in the water
	6c		Landform	Is the waterbody one of the following geomorphic types? Former channel (separate from river) Ox-bow lake (separate from river) Permanent Pond Pond that dries out	B6, B7, B8 or B9	For the function to occur water and therefore sediment needs to be trapped in the waterbody
	6d		Vegetation structure	Are one or more of the following bank vegetation types present >33%? Tall herbs/grasses Shrubs Trees and saplings	E24, E25, E27	The function is improved when water is slowed down by vegetation. This allows time for the sediment to sink to the bottom
	6	This function is performed to a high degree if indicator 6a, 6b, 6c and 6d have a positive response				
		This function is not being performed if either indicator 6a, 6b or 6c have a negative response				

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	7a	Nutrient retention function	Excess nutrients	Does one or more of the following land uses take place within the waterbody or within 50m of the top of the bank? Farming – Slash/burn without pesticide Farming – Slash/burn with pesticide Farming – Ranching Farming – Agro-forestry Mining – Riverbed Mining – Land Logging – Commercial Brick making	F3, F4, F5, F6, F9, F10, F19 or F26	These land uses will result in additional nutrients being added to the system
	7bi		Plant uptake of nutrients	Is one or more of the following waterbody and bank vegetation types present? Short herbs/creeping grasses Tall herbs/grasses Shrubs Climbers Trees and saplings Floating Emergent Submerged	E23, E24, E25, E26, E27, E29, E30 or E31	Plants take up nutrients reducing nutrient levels in the soil and water
	7bii			Is the function of floodwater detention being performed?	Indicator 3	Nutrients are often transported in water so if water is held within the system it gives a chance for nutrient processes to take place

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	7bii			Are all of the following land uses that potentially could take place within the waterbody or within 50m of the top of the bank absent from the area? Farming – Slash/burn without pesticide Farming – Slash/burn with pesticide Farming – Ranching Mining – Riverbed Mining – Land Settlement Burning Logging – Commercial Brick making	F3, F4, F5, F6, F9, F10, F17, F18, F19 or F26	If these land uses are absent then it is unlikely that excess nutrients are entering the system
	7ci		Storage of nutrients in organic matter	Is one or more of the following waterbody and bank vegetation types present? Short herbs/creeping grasses Tall herbs/grasses Shrubs Climbers Trees and saplings Floating Emergent Submerged	E23, E24, E25, E26, E27, E29, E30 or E31	Plants can store nutrients in both live and dead forms
	7cii			Does the waterbody substrate consist of one of the following? Peat	D31	Peat is made from dead plant material that can store nutrients

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	7ciii			Is the flooding regime the following for the entire year? Water present	C7	Flooded organic material with no oxygen provides good conditions for storing nutrients
	7civ			Is the waterbody one of the following geomorphic types? Cut-off channel (inlet connection to river) Former channel (separate from river) Ox-bow lake (separate from river) Permanent Pond	B3, B4, B5, B6, B7 or B8	Waterbodies with low flow or no flow conditions provide the ideal conditions for storing nutrients within organic matter
	7di		Adsorption of nitrogen as ammonium	Does the waterbody substrate consist of one of the following? Clay	D30	Clay provides an impermeable surface so water cannot infiltrate into it easily. These conditions are suitable for the indicator to occur
	7dii			Is the flooding regime the following for the majority of the year? Water present	C7	Constant water tables provide good conditions for this indicator

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	7diii			Is the waterbody one of the following geomorphic types? Cut-off channel (inlet connection to river) Former channel (separate from river) Ox-bow lake (separate from river) Permanent Pond	B3, B4, B5, B6, B7 or B8	Waterbodies with low flow or no flow conditions provide the ideal conditions for adsorption of nitrogen as ammonium
	7ei		Adsorption and precipitation of phosphorus in the soil	Does the waterbody substrate consist of one of the following? Clay	D30	Clay is important as phosphorous binds to it, providing storage of the nutrient.
	7eii			Does the flooding regime contain both of the following? Water present Water not present	C7 and C8	Fluctuating water tables provide good conditions for this indicator
	7eiii			Is the waterbody one of the following geomorphic types? Cut-off channel (inlet connection to river) Former channel (separate from river) Ox-bow lake (separate from river) Permanent Pond	B3, B4, B5, B6, B7 or B8	Waterbodies with low flow or no flow conditions provide the ideal conditions for adsorption of phosphorous
	7f		Retention of particulate nutrients	Is the function of sediment retention being performed?	Indicator 6	Nutrients, in a particulate form, will fall out of suspension when sediment is retained within a system

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	7	NB For this function an indicator occurs when there is a positive response to all questions related to that indicator. If one of the questions receives a negative response then it can be assumed that the indicator is not occurring				
		This function is performed to a high degree if there is a positive response to indicator 7a and more than three of the following indicators have a positive response (7b, 7c, 7d, 7e and 7f)				
		This function is being performed if there is a positive response to indicator 7a and three or less of the following indicators have a positive response (7b, 7c, 7d, 7e and 7f)				
		This function is not being performed if indicator 7a has a negative response or if indicator 7a has a positive response but there are not positive responses to any of the indicators 7b, 7c, 7d, 7e or 7f				
	8a	Nutrient export function	Excess nutrients	Does one or more of the following land uses take place within the waterbody or within 50m of the top of the bank? Farming – Slash/burn without pesticide Farming – Slash/burn with pesticide Farming – Ranching Farming – Agro-forestry Mining – Riverbed Mining – Land Logging – Commercial Brick making	F3, F4, F5, F6, F9, F10, F19 or F26	These land uses will result in additional nutrients being added to the system
	8bi		Gaseous export of nitrogen; denitrification	Is the waterbody one of the following geomorphic types? Cut-off channel (inlet connection to river) Former channel (separate from river) Ox-bow lake (separate from river) Permanent Pond	B3, B4, B5, B6, B7 or B8	Waterbodies with low flow or no flow conditions provide the ideal conditions for denitrification
	8bii			Is the flooding regime the following for the majority of the year? Water present	C7	Constant water tables provide good conditions for this indicator

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	8biii			Does the waterbody substrate consist of one of the following? Silt/mud Peat	D29 or D31	These substrates provide suitable chemical conditions for denitrification
	8ci		Gaseous export of nitrogen; ammonia volatilisation	Are the habitat types around the waterbody one of the following? Savanna – Flooded Savanna – Non-flooded And the extent of trees one or more of the following? Isolated/scattered Occasional clumps	E3 or E4 and E11 or E13	Ultraviolet light penetration is important for this indicator so vegetated areas that do not have canopy cover are ideal
	8cii			Is the flooding regime the following for the majority of the year? Water not present	C8	Fluctuating water tables provide good conditions for this indicator
	8ciii			Does the waterbody substrate consist of one of the following? Gravel/pebble Sand	D27 or D28	Fluctuating water tables provide good conditions for this indicator so infiltration is important
	8di		Nutrient export through land management	Is the function of nutrient retention being performed?	Indicator 7	Nutrients need to be retained within the system before they can be exported

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	8dii			Does one or more of the following land uses take place within the waterbody or within 50m of the top of the bank? Farming – Slash/burn without pesticide Farming – Slash/burn with pesticide Farming – Ranching Farming – Agro-forestry Burning Logging – Commercial Logging – Local construction Gathering – Plants Gathering - Firewood	F3, F4, F5, F6, F18, F19, F20, F29 or F30	These land uses mean nutrients are removed from the system through land management practices
	8ei		Export via physical processes	Is the waterbody one of the following geomorphic types? Main river channel Creek Cut-off channel (inlet connection to river) Former channel (separate from river) Ox-bow lake (separate from river)	B1, B2, B3, B4, B5, B6 or B7	Flowing water can transport nutrients out of the system
	8eii			Does the waterbody have hydrological inputs from either? Surface runoff Surface overbank inundation from a river	C2 or C3	These hydrological inputs indicate flowing water via which nutrients can be transported
	8	NB For this function an indicator occurs when there is a positive response to all questions related to that indicator. If one of the questions receives a negative response then it can be assumed that the indicator is not occurring.				
		This function is performed to a high degree if there is a positive response to indicator 8a and more than two of the following indicators have a positive response (8b, 8c, 8d and 8e)				

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
		This function is being performed if there is a positive response to indicator 8a and two or less of the following indicators have a positive response (8b, 8c, 8d and 8e)				
		This function is not being performed if indicator 8a has a negative response or if indicator 8a has a positive response but there are not positive responses to any of the indicators 8b, 8c, 8d or 8e				
	9a	In situ carbon retention function	Soil water regime	Is the flooding regime the following for the majority of the year? Water present	C7	Flooded conditions are required for carbon to be stored underwater within a waterbody as organic material
	9b		Landform	Is the waterbody one of the following geomorphic types? Former channel (separate from river) Ox-bow lake (separate from river) Permanent Pond Pond that dries out	B6, B7, B8 or B9	These landform types have slow or no flow conditions allowing organic matter to fall to the bottom of the waterbody
	9	This function is performed to a high degree if indicator 9a and 9b have a positive response				
		This function is not being performed if either indicator 9a and 9b have a negative response				
The wetland system is performing ideally if there is a positive response to all of the following indicators 1a, 1b, 1c, 2a, 2b, 3, 6 and either one of the following indicators: 4 or 5.						
If excessive human nutrient inputs to the system occurs the wetland system will still be performing ideally if there is a positive response to all of the following indicators 1a, 1b, 1c, 2a, 2b, 3, 6, 7, 8 and either one of the following indicators: 4 or 5.						
The wetland system is not performing ideally if there is a negative response to one of the following indicators: 1a, 1b, 1c, 2a, 2b, 3 or 6						

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
Resistance	1	Species abundance	Abundance of plant species	Is more than two of the following waterbody features and habitat characteristics present? Vegetated bank base (bank feature) Vegetated mid-channel bar (bottom feature) Mature island (bottom feature) Areas completely covered in vegetation (bottom feature) Semi-continuous (Extent of trees and associated features) Continuous (Extent of trees and associated features)	D15, D36, D37, D38, E14 or E15	Vegetation cover is a useful indication of species abundance. The more plant species there are the more resistant the system will be.
	2		Abundance of bird indicator species	Do any of the following groups have individual species numbers, recorded at a single survey visit, greater than the number stated? Parrots >20 Ducks >20 Ibises >10 Herons >20 Storks >20 Kingfishers >10 Swallows >30	Bird survey data	Species group numbers are a useful indication of species abundance. The more bird species there are the more resistant the system will be.
	3		Abundance of caiman	Were total caiman numbers, recorded at a single survey visit, greater than 30?	Caiman survey data	Caiman numbers are a useful indication of species abundance. The more caiman species there are the more resistant the system will be.

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
The wetland system is resistant if there is a positive response to one of the following indicators 1, 2 and 3						
The wetland system is not resistant if there is a negative response to all of the following indicators 1,2 and 3						
Flexibility	1	Hydrological diversity	Diversity of water input	Does the waterbody have hydrological inputs from more than one of the following: Groundwater discharge Surface runoff Surface overbank inundation from a river Surface overbank inundation from a rise in water level of a waterbody Precipitation	C1, C2, C3 or C4	For a waterbody system to be flexible it cannot rely on just one hydrological input so having more than one input is important
	2	Ecological diversity	Plant diversity	Are three or more of the following bank vegetation types or waterbody vegetation types present? Bryophytes Short herbs/creeping grasses Tall herbs/grasses Shrubs Climbers Trees and saplings Algae Floating Emergent Submerged	E22, E23, E24, E25, E26, E27, E28, E29, E30 or E31	These indicators demonstrate plant diversity. High plant diversity ensures the system can continue to exist even if some species are lost.

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	3		Diversity of bird indicator species	Are species present from at least three of the following groups? Swallows Parrots Ducks Ibises Herons Storks Kingfishers	Bird survey data	These indicators demonstrate bird diversity. High bird diversity ensures the system can continue to exist even if some species are lost. Birds are also an indicator of a diverse food web.

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	4	Diversity of habitat niches	Niche provision for macroinvertebrates	Is one or more waterbody features or habitat characteristics present for at least two of the following groups? Group 1 Boulder (Bottom substrate) Gravel/pebble (Bottom substrate) Sand (Bottom substrate) Silt/mud (Bottom substrate) Peat (Bottom substrate) Group 2 Vegetated bank base (bank feature) Vegetated mid-channel bar (bottom feature) Mature island (bottom feature) Areas completely covered in vegetation (bottom feature) Semi-continuous (Extent of trees and associated features) Continuous (Extent of trees and associated features) Group 3 Areas completely covered in debris (leaf litter) Group 4 Short herbs/creeping grasses (Bank vegetation types) Tall herbs/grasses (Bank vegetation types) Shrubs (Bank vegetation types) Trees and saplings (Bank vegetation types) Group 5 Emergent (Waterbody vegetation types) Submerged (Waterbody vegetation types)	Group1 D25, D27, D28, D29 or D31 Group 2 D15, D36, D37, D38, E14 or E15 Group 3 D39 Group 4 E23, E24, E25 or E27 Group 5 E30 or E31	These indicators demonstrate a diversity of habitat niches for macroinvertebrates and therefore a diversity of macroinvertebrate species. High species diversity ensures the system can continue to exist even if some species are lost.

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	5		Niche provision for herpetiles	Is one or more waterbody features or habitat characteristics present for at least two of the following groups? Group 1 Water present (Flooding regime) Group 2 Bedrock (bank material) Boulder (bank material) Gravel/sand (bank material) Bedrock (bottom substrate) Boulder (bottom substrate) Gravel/sand (bottom substrate) Group 3 Sheet rock (Habitat niches) Victoria amazonica (Habitat niches) Guavaballi (Habitat niches) Moco moco (Habitat niches) Nymphaea (Habitat niches) Arapipi Palm (Habitat niches) Water Hyacinth (Habitat niches) Group 4 Emergent (Waterbody vegetation types) Submerged (Waterbody vegetation types)	Group1 C7 Group 2 D17, D18, D20, D24, D25 or D28 Group 3 E33, E34, E36, E37, E39, E41 or E42 Group 4 E30 or E31	These indicators demonstrate a diversity of habitat niches for herpetiles and therefore a diversity of herpetiles species. High species diversity ensures the system can continue to exist even if some species are lost.

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	6		Niche provision for fish	Is one or more waterbody features or habitat characteristics present for at least two of the following groups? Group 1 Water present (Flooding regime) Group 2 Shading of waterbody (Extent of trees and associated features) Overhanging trees (Extent of trees and associated features) Underwater tree roots (Extent of trees and associated features) Fallen trees (Extent of trees and associated features) Group 3 Victoria amazonica (Habitat niches) Nymphaea (Habitat niches) Water Hyacinth (Habitat niches) Group 4 Emergent (Waterbody vegetation types) Submerged (Waterbody vegetation types)	Group1 C7 Group 2 E16, E17, E18 or E19 Group 3 E34, E36 or E42 Group 4 E30 or E31	These indicators demonstrate a diversity of habitat niches for fish and therefore a diversity of fish species. High species diversity ensures the system can continue to exist even if some species are lost.

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	7		Niche provision for mammals	Is one or more waterbody features or habitat characteristics present for at least two of the following groups? Group 1 Stable earth bank (bank features) Earth (bank material) Sticky clay (bank material) Group 2 Vegetated bank base (bank feature) Vegetated mid-channel bar (bottom feature) Mature island (bottom feature) Areas completely covered in vegetation (bottom feature) Semi-continuous (Extent of trees and associated features) Continuous (Extent of trees and associated features) Group 3 Otter dens and campsites (Habitat niches) Tapir entrances (Habitat niches) Group 4 Short herbs/creeping grasses (Bank vegetation types) Tall herbs/grasses (Bank vegetation types) Shrubs (Bank vegetation types) Trees and saplings (Bank vegetation types) Group 5 Emergent (Waterbody vegetation types) Submerged (Waterbody vegetation types)	Group1 D13, D21 or D22 Group 2 D15, D36, D37, D38, E14 or E15 Group 3 E32 or E40 Group 4 E23, E24, E25 or E27 Group 5 E30 or E31	These indicators demonstrate a diversity of habitat niches for mammals and therefore a diversity of mammals species. High species diversity ensures the system can continue to exist even if some species are lost.

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	8		Niche provision for birds	Is one or more waterbody features or habitat characteristics present for at least two of the following groups? Group 1 Stable earth bank (bank features) Earth (bank material) Sticky clay (bank material) Unvegetated mid-channel sand bar (bottom features) Group 2 Vegetated bank base (bank feature) Vegetated mid-channel bar (bottom feature) Mature island (bottom feature) Areas completely covered in vegetation (bottom feature) Semi-continuous (Extent of trees and associated features) Continuous (Extent of trees and associated features) Group 3 Victoria amazonica (Habitat niches) Guavaballi (Habitat niches) Moco moco (Habitat niches) Nymphaea (Habitat niches) Arapipi Palm (Habitat niches) Water Hyacinth (Habitat niches) Group 4 Short herbs/creeping grasses (Bank vegetation types) Tall herbs/grasses (Bank vegetation types) Shrubs (Bank vegetation types)	Group1 D13, D21, D22 or D35 Group 2 D15, D36, D37, D38, E14 or E15 Group 3 E34, E36, E37, E39, E41 or E42 Group 4 E23, E24, E25 or E27 Group 5 E30 or E31	These indicators demonstrate a diversity of habitat niches for birds and therefore a diversity of birds species. High species diversity ensures the system can continue to exist even if some species are lost.

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
The wetland system is flexible if indicator 1, 2, 3 and at least three of 4, 5, 6, 7 and 8 have a positive response						
The wetland system is not flexible if indicator 1, 2, 3 and / or more than three of 4, 5, 6, 7 and 8 have a negative response						
Adaptability	1	Transport mechanisms via water	Hydrological connection	Does the waterbody have hydrological inputs from either? Surface runoff Surface overbank inundation from a river	C2 or C3	For a wetland system to be adaptable then water from outside the system needs to enter into it as it can bring in nutrients and species
	2	Transport mechanism via birds	Migratory species	Are any of the bird species recorded migratory species either internationally or within the region?	Bird survey data	Migratory birds are important as they themselves bring new species to the waterbody but they can also transport plant species through seeds

System health property	Indicator number	Indicator category or function	Measurable indicator	Description	Method code	Assumption
	3	Plant species availability around the waterbody	Habitat type	Does the waterbody have one of the following habitat types around it? Forest - Flooded Forest - Non-flooded Savanna - Flooded Savanna – Non-flooded	E1, E2, E3 or E4	It is important that different sources of plant species are available surrounding the waterbody so the transport mechanisms can bring in the new species. Without a source of species the system cannot be adaptable to changing conditions
The wetland system is adaptable if indicator 1, 2, 3 have a positive response						
The wetland system is not adaptable if one or more of indicator 1, 2, 3 have a negative response						

4.4 Planning and re-planning

The planning technique proposed in this section, the logframe, supports stakeholders in thinking through the different aspects of action plans. These aspects include the overall goal, the associated outputs and activities, the responsibilities and the necessary resources. Developing a logframe also involves an element of negotiation to arrive at a consensus.

Planning for action using log frame

The logical framework (or logframe) approach provides a set of designing tools that, when used creatively, can be used for planning, designing, implementing and eventual evaluation of natural resource management. Logframes provide a structured, logical approach to setting priorities and determining the intended results and activities of a project. However, they should not stop users from adapting logframes for their own needs and approaches, and designing them in more appropriate forms. Table 4.4 shows an example of a logframe and the following explains the main aspects:

1) Goal – this is the overall goal or vision for management;
2) Aims – these are the aims or purpose of management. There may be one or several aims;
3) Outputs – these reflect what will be produced to achieve the aims;
4) Measurable indicators – these will show whether or not aims/outputs have been achieved. Each indicator should relate to an explicit aim/output, be measurable and can be qualitative or quantitative. See *What is an indicator?* section for more details;
5) Means of verification - once indicators have been developed, the source of the information and means of collection (means of verification-MOV) should be established for each indicator. A MOV should test whether or not an indicator can be realistically measured at the expense of a reasonable amount of time, money and effort. The MOV should specify the format in which the information should be made available (e.g. reports, records, research findings, publications), who should provide the information and how regularly it should be provided;
6) Activities – list the activities that will be undertaken to achieve each output. For each of these activities, indicate who will carry out the activity (this could be a group of people or named individuals) and the period during which the activity will be carried out.

Table 4.4 An example of a design for a logframe. See text for explanation of how to complete.

Project summary	**Measurable indicators**	**Means of verification**
Goal:		
Insert the overall goal		
Aims:		
Insert the aims that will help to achieve the overall goal	*Insert the indicators that will represent the aims*	*Insert the proof or evidence that will be given to confirm that the aims have been achieved*

Output 1. (*insert outputs with activities relevant to that outputs in lines below*)	*Insert the indicators that will represent the outputs*	*Insert the proof or evidence that will be given to confirm that the outputs have been achieved*
Activity 1.1 (*insert activities relevant to this out put*)	*Insert who will carry out this activity and when*	
Activity 1.2, etc		
Output 2.	*Insert the indicators that will represent the outputs*	*Insert the proof or evidence that will be given to confirm that the outputs have been achieved*
Activity 2.1.	*Insert who will carry out this activity and when*	
Activity 2.2. etc		

Table 4.5 Completed logframe for the Darwin Initiative second phase project

Project summary	**Measurable indicators**	**Means of verification**
Goal:		
To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but poor in resources to achieve • the conservation of biological diversity, • the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources		
Aims:		
Build capacity of stakeholders at both local and national levels in implementing the North Rupununi Adaptive Management Plan (NRAMP) in ways that are ecologically, socially and financially sustainable	New understanding of the impact NRAMP has on ecological sustainability of wetland systems, economic equity, social justice and cultural diversity within the Rupununi region Continued implementation of NRAMP by Guyanese partner organisations Evidence of sustainable management and the maintenance of wetland biodiversity Increased awareness of wetland biodiversity conservation issues at local and national levels Sustainable livelihoods achieved through activities	Internal reports from Guyanese partner organisations related to sustainable management of wetland biodiversity Wetland training, monitoring and education programmes adopted by Guyanese organisations Wetland species and habitat monitoring reports from partner organisations Income generated from sustainable livelihoods

	such as eco-tourism	
Output 1. Community wetland monitoring and eco-tourism course	1a) Course documentation and materials 1b) 6 trained trainers to implement wider training within local communities 1c) Wetland habitat guides for tourists 1d) 3 Earthwatch expeditions per year	1a) Feedback from documentation review 1a) 2 copies of course material sent to Darwin Initiative 1b) Trainee evaluation questionnaire and attendance records 1c) 2 copies of course material sent to Darwin Initiative 1d) Expedition participant attendance records
Activity 1.1 Training of trainers for community wetland monitoring and eco-tourism course and initiation of course development	The UK and Guyana team members - 1wk Feb07	
Activity 1.2 Evaluation and adaptation of training course material	Guyana team members - Mar07 to May07	
Activity 1.3 Community wetland monitoring and eco-tourism training programmes	Guyana team members - Jun07 to Feb08	
Output 2. Wetland monitoring and management ranger and environment officer training course	2a) Course documentation and materials 2b) 6 trained trainers to implement training of biodiversity conservation NGOs and EPA staff	2a) Feedback from documentation review 2a) 2 copies of course material sent to Darwin Initiative 2b) Trainee evaluation questionnaire and attendance records
Activity 2.1 Training of trainers of wetland monitoring and management ranger and environment officer course and initiation of course development	The UK and Guyana team members - 1wk Feb07	
Activity 2.2 Evaluation and adaptation of training course material	Guyana team members - Mar07 to May07	
Activity 2.3 Wetland	Guyana team members - Jun07 to Feb08	

monitoring and management ranger and environment officer training programmes		
Output 3. Wetland biodiversity primary school teacher and student packs	3) 16 local community school resource packs for teachers and students published	3) Review and feedback on course material at local and national level
Activity 3.1 Development of materials	UK and Guyana team members - Oct06 to Sep07	
Activity 3.2 First draft, consultation and review	Guyana team members - Oct07	
Activity 3.3 Second draft, pilot implementation and evaluation	UK and Guyana team members - Feb08	
Activity 3.4 Published	Guyana team members - Mar08	
Output 4. Sustainable management of wetland biodiversity university postgraduate course	4) Course lecture material and resources produced	4) Review and feedback on course material within University of Guyana, Open University and Royal Holloway
Activity 4.1 Development of materials	UK and Guyana team members - Oct06 to Sep07	
Activity 4.2 First draft, consultation and review	Guyana team members - Oct07	
Activity 4.3 Second draft, pilot implementation and evaluation	UK and Guyana team members - Feb08	
Activity 4.4 Published	Guyana team members - Mar08	
Output 5. NRAMP Impact Assessment Report	5a) Workshops completed 5b) Report peer reviewed and distributed to all stakeholders	5a) List of attendees 5b) ECOSENSUS database updated 5c) 3D participatory model of Rupununi 5d) 2 copies of report sent to Darwin Initiative
Activity 5.1 First stakeholder workshops - assess implementation of NRAMP using ECOSENSUS platform, develop 3D Rupununi model and undertake first iteration of NRAMP impact assessment	UK and Guyana team members - 4wks Jan/Feb 07	
Activity 5.2 Second	UK and Guyana team members - 1wk Aug07	

stakeholder workshops – second iteration of NRAMP impact assessment		
Activity 5.3 Final workshop – third iteration of NRAMP impact assessment and presentation of findings	UK and Guyana team members - 1wk Feb08	
Output 6. Publications, presentations and exhibitions	6) 6 radio and 2 TV broadcasts; 4 newspaper articles; permanent wetland biodiversity exhibitions; 6 quarterly wetland stakeholder bulletins; 2 papers published in peer reviewed journals; Rupununi wetland website	6) Copies of all publications and recordings sent to Darwin Initiative
Activity 5.1 3 radio and 1 TV broadcasts	UK and Guyana PIs – every year	
Activity 5.2 1 national newspaper article	Guyana PI – every year	
Activity 5.3 2 UK press releases	UK PIs – one a year	
Activity 5.4 Permanent wetland biodiversity exhibitions	UK and Guyana team members - Feb08	
Activity 5.5 4 wetland stakeholder bulletins	Guyana team members – every year	
Activity 5.6 2 papers published in peer reviewed journals	UK and Guyana PIs - Dec 08	
Activity 5.7 Rupununi wetland website	Guyana PI - Feb07 to Nov08	
Activity 5.8 Articles within WWT, Royal Holloway and OU publications	UK PIs – Feb 07 to Nov08	

Table 4.6 A logframe developed at a stakeholder forum held in September 2007 in the North Rupununi. See Box 4.1 for details.

Overall Goal: - To develop alternatives to reduce dependency on natural resource							
Specific Goal	Outputs	Activities	When	Who	Resources	Indicators	Assumptions
To develop alternative livelihood activities that will ensure food security	Reliable and constant source of protein Continued use and existence of traditional resources in a sustainable manner	Farming of livestock, for example pigs, cows, sheep, goats, chickens and turkeys.	2008	Villagers, Ministry of Agriculture, Guyana School of Agriculture	Breeding stock, technical expertise to rear specific livestock, proper holding facilities for livestock, land, food source for livestock	Reduction in the hunting pressures of wild game Reduction in the number of persons with protein deficiency ailments (stunted growth, reduced resistance to infections and fatigue)	The livestock chosen is appropriated for the condition in the Rupununi Proper husbandry is done, so that the input is not more than what is produced Villagers are happy using an alternative source of protein
		Establishment of artificial and natural fish ponds in communities for local fish species of the area	2009	Villagers, NGOs (NRAMP), Ministry of Fisheries, Crops and Livestock, GSA	Land, technical assistance to set up fish ponds, local fish species breeding stock, materials and equipment to	Reduction in the level of use of traditional fish resource use areas Increased availability of fish	Fish ponds are successful in allowing fishes to breed and grow Community members set a

					set up fish ponds	throughout the year Increase in the native/local fish species populations	system in place for sharing and use the fish from the fish ponds
To develop alternative livelihoods activities that will allow for income generation	Increase in the income that is generated by the communities from local products and produce Development of skills of community members to take responsibilities in small business enterprises in the community	Develop and implement furniture making workshops and groups Develop handicraft groups that will make high quality products for tourists Develop food processing centres in communities so that food/fruit resources are not wasted	2008 2008 2009 - 2010	Villagers, NGOs Villagers, Tourism entities/initiatives in the North Rupununi Village Council, Government, and NGOs	Technical expertise, materials and skills for construction of furniture, and handicraft products, training for business management	Increase job opportunities within communities Increased income generation in communities Improved financial management within village businesses and initiatives Increased number of tourists wanting handicraft	Community members are interested in pursuing these alternatives completely Support is given by NGOs and Government for implementing these livelihood activities There is a proper marketing strategy in place to

						products from the area Reduction in the amount of fruit that is wasted	showcase the products derived from these alternative livelihoods

4.5 Implementation and re-implementation of the plan

To implement the plan requires careful management and co-ordination of effort. Management of resources such as people, money, materials, energy, infrastructure and communication needs to occur to ensure successful implementation of the plan. Many good plans fail because they are not appropriately implemented. This can be because insufficient thought, during the development of the plan, was given to how it will operate and be managed, and because successful management tools were not adopted. The following sections describe a series of management tools and approaches to assist in management plan implementation.

4.5.1 Plan management

Initially it is important to determine the management structures required to implement a plan. As outlined in the *NRAMP principles* section, the plan will only succeed if there are a concerted group of champions willing to put the health of the North Rupununi communities and ecosystems first. NRAMP champions can be identified as holding three distinct roles: members of the Plan Steering Committee; plan/project managers; and, plan/project staff:

- Level 1 - Plan Steering Committee – The role of this body is to oversee plan implementation, assess the quality of outputs, agree annual budgets and resourcing and appoint a plan manager. This committee should not get involved in day-to-day management issues. A steering committee can be made up of stakeholders, management board of an organization or community representatives.
- Level 2 – Plan/Project Manager – This individual is responsible for the delivery of the plan on time, to budget and to the satisfaction of the steering committee. They are responsible for the day-to-day decisions, financial management, reporting, staff management and communication. They should report directly to the steering committee.
- Level 3 – Plan/Project Staff – These individuals are responsible for assisting the project manager in implementation of the plan including the appropriate reporting and communication. They should report directly to the project manager.

4.5.2 Project manager's duties

There are a variety of tasks a project manager has to undertake and take responsibility for to ensure successful delivery of a plan (Table 4.7).

Table 4.7 The principle tasks of a project manager

Duty	Description
Implementation Workplan	Development of a comprehensive workplan that describes clear objectives, responsibilities, time allocations and dates of delivery. The plan should include a Gantt chart (Gantt charts illustrate the start and finish dates of critical plan activities in the form of a bar chart).
Staff management	Ensuring all staff are briefed on the overall plan goal, their individual role within the workplan, fieldwork requirements, reporting contribution and timetable for delivery. Providing regular assessment of staff performance and feedback to staff.
Plan management meetings	Setting up and running initial start up meeting with all staff, implementing regular team meetings to coordinate project delivery and regular individual staff meetings to discuss performance.

Financial management	Tracking the amount of time used by staff and cross-checking it with the budget allocation, informing staff of the amount of time they have for allocated tasks, tracking project expenditure, including expenses and purchases, to ensure plan remains within budget.
Reporting	Regular reporting to the steering committee and stakeholders of plan implementation progress against the workplan, financial situation and any other management issues such as staff resourcing.
Liaising with the steering committee and other stakeholders	Establishing a clear line of contact with the steering committee, keeping the steering committee informed through regular contact and meetings and alerting the steering committee immediately to any fundamental changes in the work programme.
Planning field work	Coordinating any field work, organizing and fully instructing staff, ensuring access is permitted and keeping fieldwork records.
Managing paper files	Ensuring that all plan documentation is correctly filed and coordinating the storage of documents in one single location.
Managing electronic files	Ensuring that all project electronic files are correctly stored and named, tidying up folders and files into appropriate locations.
Report preparation	Planning, supervising and checking of reports and outputs, instructing staff clearly over their reporting requirements, ensuring all reports and outputs are checked prior to issue.
Equipment	Ensuring that any required equipment is purchased on time, checking that any equipment used is returned correctly in an appropriate condition.
Health & Safety	Ensuring all staff are informed of Health & Safety issues, making sure that staff have completed relevant risk assessments.

4.5.3 Meeting and reporting schedule

Meetings and reporting are valuable communication tools within plan implementation. Informal communication is also important but formal communication strategies are essential if successful delivery of the plan is to be achieved. The meeting and reporting schedule should be agreed between the steering committee and project manager before the plan is implemented. The exact schedule is determined by the scope, time and cost of the plan. However, a suggested approach for meetings and reporting is given in Table 4.8.

Table 4.8 Approaches to meetings and reporting

Meetings	**Attendees**	**Timing**	**Scope of meeting**
Steering committee meeting	Steering committee and project manager	Quarterly	Project manager reports progress to the committee on plan progress and financial situation
Plan start-up meeting	Project manager and all staff	Start of plan implementation	Introduction to overall plan goal, staff role within the workplan, fieldwork requirements, reporting contribution and timetable for delivery
Plan management meetings	Project manager and all staff	Monthly	Review of plan progress against workplan and discussion of any management issues
Diary meeting	Project manager and all staff	Weekly	Review of staff location and priorities for coming week
Staff individual meetings	Project manager and individual staff	Monthly	Review of staff performance with positive feedback
Reporting	**Sent to**	**Timing**	**Scope of report**
Regular progress report	Steering committee	Monthly	1 page report describing plan progress against workplan
Financial and progress report	Steering committee	Quarterly	5 page report describing progress against workplan and current financial situation against budget
End of learning cycle report	Steering committee	Annual or longer depending on length of time of learning cycle iteration	Detailed report describing the implementation of the plan against the workplan and financial implementation against budget

5. Implementing NRAMP

In the following sections, we outline case examples of the NRAMP approach as it has evolved into the process currently outlined in this document.

5.1 Exploring water resources in the North Rupununi, 1999 to 2002

5.1.1 Goal setting

In 1999, Dr Norma Bubier, an anthropologist working with the communities of the North Rupununi, contacted Jay Mistry, Matthew Simpson and Andrea Berardi, with regards to setting up environmental monitoring with the communities in the area. Dr Bubier was hoping to get some preliminary data to assess the present situation, and train the local Amerindians to monitor their own environment.

5.1.2 Observing

The UK team members hence raised funds to undertake an expedition to the region. Funding was provided by the Royal Geographical Society, Royal Holloway, University of London, Mercers Trust and the British Academy. The aim of the expedition, which took place December 1999 to February 2000, was: 1) to assess the impact of land use change on the ecology and hydrology of riparian and in-stream areas ecologically and economically important to the Makushi Amerindian communities of the Rupununi District, SW Guyana; 2) to establish a community based ecological monitoring scheme of local waterways.

The head of Surama Village, Mr Sidney Allicock, was particularly keen to collaborate on this project, so we decided to carry out an in-depth analysis of this village, and more general surveys of the other villages. The project therefore began with a workshop for the Surama community and the research team. This helped to introduce the research team to community members, and outline the objectives and methods of the project. This also helped to identify core areas of concern of the community to local water resources, sites of particular significance to different community members, and community members who would be willing and interested to participate in the research with the research team. Mr Yung Sandy joined the research team for the duration of the project. From Surama village, we carried out a series of surveying expeditions to a number of water bodies, the most significant of which was a 5 day survey of the Burro-Burro River. Having completed our study of the Surama hinterland, we then surveyed a portion of the Rupununi River catchment, including the villages of Annai, Crashwater, Rewa, Wowetta, Rupertee and Apoteri.

Data was gathered in a number of ways which are fully described in Mistry *et al.* (2004). Firstly, in-depth interviews were carried out with the villagers about their water sources and uses. To assess the impact of land use change on the hydrology and ecology of riparian and in-stream areas important to the Makushi three separate surveys were undertaken:

1) river habitat survey – this is an observational method for classifying waterbodies according to their habitat quality and land use impact;
2) water quality survey – the water quality parameters measured were general variables (temperature; suspended solids (turbidity); conductivity; pH; dissolved oxygen), major ions (ammonia; chloride; nitrate; nitrite; phosphate), other inorganic variables (salinity) and trace elements (aluminium; magnesium; iron).
3) bird survey - timed bird surveys were undertaken in the same locations as the river habitat and water quality surveys. They were carried out by Yung Sandy, an expert in the identification of bird species. All species identified via visual sightings or via their call were recorded over a one hour period from a position on the water body bank.

All three surveys were undertaken in the pools, creeks, lakes and rivers that the Makushi use for fishing. The water quality survey also included the rivers, water holes and wells that the Makushi use for drinking and washing.

5.1.3 Evaluating

The data collected was analysed in various ways including tabular summaries, graphs, simple statistics such as means and more complex statistics such as multivariate analyses. Full details of these and the results can be found in Mistry *et al*. (2004). The main findings of the study were as follows:

1) Fishing is the dominant service from the water sources (excluding the water holes). The pools and creeks become particularly important in the dry season as an easy source of fish, these being close to the village. However, they support only a limited range of fish species, and for greater diversity, the rivers are used;
2) There was no significant evidence that mining or other human activities were having an effect on the water quality parameters measured.

Overall, the results show that there is no impact, as yet, from land use change on the water quality or habitats surveyed. The data collected showed that the environment where the Makushi live was pristine. However, these were one off measurements, and since seasonal variations may be significant, regular monitoring was needed. The expedition ended with a workshop in Surama Village during which the results of the project were presented to the village members. A monitoring scheme was also proposed and discussed, to be undertaken by Yung Sandy. However, lack of funding and human capacity meant that this did not take place.

5.1.4 Planning and goal-setting for water resources

During the expedition, discussions with community leaders such as Sidney Allicock, and Dr Graham Watkins, then senior biologist with the Iwokrama International Centre, highlighted the need to expand the monitoring of the waterbodies over space and time to get a true picture of the state of the waterbodies throughout the North Rupununi. This directly led to the development and submission of a proposal to the Darwin Initiative (DEFRA) in 2002 (see the *Development of the NRAMP* section for full details). The project had the following main objectives:

- To transfer research and management techniques and technology through training
- To classify and map the waterbodies and habitats of the North Rupununi and to identify sites for monitoring
- To undertake surveys of habitat quality and key species distribution in the selected sites
- To develop indicators and management plans for the region.

The proposal was successful and funding for the project commenced in September 2003. The logframe for the planned research is shown in Table 5.1.

Table 5.1 Logframe for the first phase of the Darwin Initiative Wetlands project

Project summary	Measurable indicators	Means of verification	Important assumptions
Goal:			
To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but poor in resources to achieve · the conservation of biological diversity, · the sustainable use of its components, and · the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources			
Purpose			
To build capacity for effective management of the Iwokrama Forest and Rupununi Wetlands and Savannas of Guyana, through training and the development of sustainable ecosystem management plans	New understanding of the relationships between environmental determinants, key species distributions and impacts of land-use change that will inform management plans Long-term monitoring and management strategies resulting in effective conservation of key habitats and species Evidence of sustainable development and key habitat and species conservation	Management plans for key habitats and species in use Records of implementation from Government and North Rupununi District Development Board meetings Field survey reports and publications by partner organisations	Partner organisations are successful in incorporating knowledge and implementing management strategies within the region The project partnership is successful in attracting additional support to continue monitoring and implementation of management plans beyond the period of the project
Outputs			
1) Trained local community members and staff within the partner organisations 2) North Rupununi Field Manual (NRFM) 3) North Rupununi Ecosystems Management Plan (NREMP) 4) Publications and presentations	1) 10 staff trained in monitoring, data analysis & management and 1 graduate Masters student 2) Monitoring protocols and data recording sheets produced and peer reviewed, publication and distribution arranged 3) GIS spatial database of ecosystem and species characteristics, stakeholder fora reports, NREMP peer reviewed, publication and distribution arranged 4) 6 radio and TV items, 3 news paper items, posters, 2 papers	1) Masters degree certificate, field survey reports, trainee evaluation questionnaire and training attendance records 2) 2 copies of NRFM sent to Darwin Initiative 3) Interactive spatial database held in Iwokrama and UK and published on web, 2 copies of NREMP sent to Darwin Initiative + published reviews and publications 4) All transcripts and papers sent to Darwin Initiative	1) A high % of participants attend and pass the training 2)Publishers and distribution method identified successfully 3) Co-operation between Makushi, government and NGOs maintained, access to remote areas for ground truthing of remote sensed images is possible, publishers and distribution method identified successfully

Activities	Activity Milestones (Summary of Project Implementation Timetable)
Workshops and Stakeholder Fora Field research programme Management plan development Publicity material	Yr1: Start-up workshop - project team to plan work programme, identify key tasks and develop training programme and materials (1 wk Aug 03), Stakeholder forum (1 wk Aug 03); Habitat and species survey training (2 wks Sep 03); Land-use survey training (1 wk Sep 03). Yr 2: Mid-term workshop - data analysis and management plan development training (2 wks Sep 04), Stakeholder forum (1 wk Sep 04). Yr 3: Final workshop - management plan development (2 wks Nov 05). Eco-hydrogeomorphic classification of habitats Jul 03: Identification of land-use types Jul 03: Mapping of habitat types and land uses using remote sensed data Oct 03: Identification of reference sites for habitat and species survey Oct 03: Habitat and species surveys Oct03-Oct05: Land-use surveys Oct03-Oct05: Database of habitat, species and land-uses Nov05. Collation and analysis of data Jan 06: Draft management plan Mar 06: Published Aug 06. 2 radio or TV items (each yr); 1 newspaper article (each yr); 2 papers (by Sep 06); progress reports

5.2 Darwin Initiative Wetlands Project (first phase) - sustainable management of the North Rupununi

5.2.1 Observing

5.2.1.1 Social and ecological monitoring

When the North Rupununi Wetlands project began in 2003, it was important to develop a monitoring protocol that would provide useful data for management. Although a number of institutions both within and outside Guyana had carried out various ecological and social studies in the North Rupununi, it became apparent that many of these had been one off, snapshot studies, explaining the situation in one time frame for a species or a community. There were few if any longer term regional monitoring studies that could help to form a baseline upon which future ecological and/or social changes could be assessed.

But what data needed to be collected? Monitoring numbers of bird species or black caiman, or recording monthly household fish consumption are all interesting and worthwhile, but what real, decision-making use could these data have? The data collected had to lie within a useful decision-making framework. Although there are various frameworks for natural resource management, it was decided that above all, health, whether it be for a person, animal, plant or wetland type, was paramount to the appropriate functioning of the ecology and the culture of the North Rupununi system. As such, the framework of the North Rupununi social-ecological wetland system, outlined in detail in the State of the Rupununi Report (2006), was developed. The indicators, i.e. data collected, were then chosen to represent the health of this social-ecological wetland system. Details about these indicators, how they give you an idea about the healthy functioning of the North Rupununi social-ecological wetland system, and how to measure them, are given in the *Observing and re-observing activity* section.

5.2.1.2 Capacity building

At the same time as making sense of what information needed to be collected, it was also necessary to understand whether there was sufficient know-how in individuals to be able to collect the information. A previous survey of skills and knowledge of the staff working on the North Rupununi Wetlands indicated that further capacity needed to be built in some key areas. Therefore, a training programme was implemented over

the three years of the project, to build capacity in the following: habitat and species survey techniques; land-use type survey techniques and GPS mapping; stakeholder engagement and analysis; data analysis and GIS analysis; environmental decision-making and management plan development; and adaptive management planning (Table 5.2).

Table 5.2 An outline of the project capacity building activities

Training	Topics covered	Purpose	Form
The learning cycle	The stages of observation, evaluation, planning and action within project management	To help participants understand the importance of evaluating and monitoring activities within the project and changing actions accordingly	Seminars, group exercises
Habitat, species and land use survey techniques	Wetland social-ecological systems, indicators of health, criteria for selecting monitoring sites, designing the field datasheet	To equip participants with the knowledge and skills to carry out ecological monitoring using key indicators	Group exercises, brainstorming, seminars, fieldwork
GPS mapping	Map features, locating positions	To provide participants with ability to mark significant geographical locations	Fieldwork exercises
Stakeholder engagement and analysis	Identifying stakeholders, their levels of power and their relationships to one another. Dealing with conflicts, concerns, values and beliefs. Identifying decision making structures, the processes of decision making and the location of key resource personnel.	To help participants identify, understand and manage the role of various stakeholders in natural resource management	Group exercises and brainstorming
Social survey methods	Semi-structured interviews, focus groups, transect walks, seasonal calendars	To equip participants with skills to be able to collect social indicator data	Individual and group exercises, role-playing
Data management	The need for good data management and how databases built to fit intended types of analyses	To help participants understand the importance of good data management	Seminars
Data analysis	Data verification, missing data, exploratory data analysis (summarising data in tables and graphs), analysis to inform decision-making	To equip participants with the skills to be able to carry out simple, but effective data analyses for informing management and decision-making	Seminars, individual and group exercises

Geographical information systems and participatory 3-D modelling	Different forms of spatial information, integrating spatial information, using spatial information to make recommendations/decisions, 3-D modelling	To equip participants with the skills to integrate spatial information in a simplified form using a participatory approach for decision-making	Seminars, individual and group exercises, group model building
The process of adaptive management	Approaches to natural resource management planning, the learning cycle as a basis for adaptive management, the stages of the learning cycle in adaptive management, the logframe as a tool for adaptive management	To equip participants with the skills to be able to facilitate adaptive management in the local communities	Group exercises, brainstorming, logframe construction

5.2.1.3 Data collection

Ecological system

The North Rupununi Monitoring Manual (2006) outlines the key indicators of various social and ecological functions that were developed for the North Rupununi social-ecological wetland system. For the ecological system, key indicators were monitored over a two year period, which commenced in March 2004. Sites were selected by stakeholders from the local communities, the Iwokrama International Centre and the University of Guyana. Satellite images, resource maps and local knowledge of the area were used to identify potential monitoring sites using the criteria of waterbody type (e.g. pond that dries out, river, creek etc.) and habitat type (forest or savanna). Local and scientific knowledge identified these two criteria as potentially the most important for wetland ecological functioning. Second order criterion used for site selection was the presence of land use activities in and around the waterbodies and the accessibility of the site.

Once a list of potential sites was complied, a two week field trip to a total of 47 sites was undertaken. This reconnaissance trip allowed the identification of sites for monitoring, based on whether they fit the criterion and whether they were really accessible both in the dry and wet seasons. At the end of the trip, 33 sites were chosen to conduct the monitoring activities: 9 of these sites were in the Iwokrama Forest, 8 in the savanna and the remaining 16 sites along the Rupununi and Essequibo Rivers. After the first twelve months of monitoring, two sites were dropped after consideration of site representation and logistical difficulties. As such, two years of monthly data was collected for 31 sites (Table 5.3), with monitoring activities concluded in April 2006. The methodology for collecting each indicator can be found in the North Rupununi Monitoring Manual (2006).

Table 5.3 List of 31 ecological monitoring sites

5 Miles Swamp	Kwaimatta Landing
8 Miles Swamp	Lake Amoco
Airstrip Pond	Marvin Pond
Burro Burro River	Paddle Rock Pond
Cajueiro Pond	Pygmy Inlet
Corkwood Swamp	Rewa River Transect
Cowhead Transect	Sand Landing River Transect
Crash Water Creek	Semonie Creek
Devil Pond	Siparuni River
Diamond W	Small Black Water Pond
Dixie Pond	Stanley Lake
El Dorado	Surama Pond
Grass Pond	Wagon
Hunt Oil Landing	Yakarinta Landing
Iguana Pond	Yakarinta Pond
Itch Pond 3	

Social system

The collection of social system indicators began in January 2005 and continued until August 2006 through a series of visits to the fifteen communities of the North Rupununi (Table 5.4). A range of techniques including semi-structured interviews, focus groups, transect walks and seasonal calendars were used and descriptions of the techniques can be found in the North Rupununi Monitoring Manual (2006). However, within the timeframe of the project and issues of accessibility to communities at various times of the year, it was not possible to collect information on all the indicators.

Table 5.4 List of fifteen North Rupununi communities where social data was collected

Annai
Apoteri
Aranaputa
Crashwater
Fairview
Kwaimatta
Kwatamang
Massara
Rewa
Rupertee
Surama
Toka
Wowetta
Yakarinta
Yupukari

5.2.2 Evaluating

5.2.2.1 Data management

It was essential to establish a database within which the information collected could be stored. For fieldwork, ecological indicator data was collected on a pre-determined field datasheet which was designed by the project staff. At the same time, a database structure was established in Microsoft Access as the electronic store of the ecological information. This was designed in a user-friendly form which allowed users to click on icons for different forms of data. It was also established in a form which would allow easy conversion to other software programmes for data analyses. The social indicator information was collected in the form of field notes, which were then transcribed onto an Excel database, again designed in a user friendly form allowing the user to easily input information. A system for regularly inputting information and producing backups of the electronic databases was established.

5.2.2.2 Data analysis and results

Before any data analyses could begin, it was important to verify the data collected. This was vital in order to identify any errors in data and also identify missing data points. For the latter, it was then necessary to imputate or fill in the missing data. The methods used for imputation are outlined in the *Evaluating and re-evaluating the situation* section.

Once imputation was complete, exploratory data analyses began. It was important to firstly establish the reasons for data analysis as this would determine the methods employed. For this project they included:

1) to summarise data collected on the social and ecological indicators in a form that would be the basis of and support further discussions on adaptive management in the North Rupununi wetlands;

2) to identify any patterns and trends in the data over time;
3) to look for relationships between different indicators; and
4) to be able to assess the health of the North Rupununi wetland social-ecological system.

As such, a range of methods were used to analyse the information - these are outlined in the *Evaluating and re-evaluating the situation* section. These involved synthesizing data according to certain criterion, summarizing data in tables, and graphing data. The State of the North Rupununi Wetlands Report (2006) gives examples of these outputs. For example, the social indicator data was synthesized according to whether they were social structures or processes. The ecological bird indicator data was summarised according to main habitat and maximum occurrence in wet and dry seasons and shown in the form of tables. The water depth and caiman numbers were plotted against month to show the patterns over the year.

These simple ways to manipulating the data helped to identify potential relationships between different indicators. For example, birds, one of the key indicators for different wetland ecological functions, showed differences in composition and abundance between different habitat types, namely between forest and savanna, as well as different waterbody types. As we wanted to see the relationships among many different bird species and many other indicators (e.g. habitat, waterbody, habitat features, waterbody features), it was then necessary to carry out multivariate (multiple variables/factors) analyses. This form of analysis using specialist computer software allows the user to explore and identify the relationships among the multiple variables. It also gives an indication on the relative importance of different relationships. More details on multivariate analysis are given in the *Evaluating and re-evaluating the situation* section.

The ecological and social data analysis results are presented in the State of the North Rupununi Wetlands Report (2006).

5.2.2.3 Spatial data analysis

The key activity here was to identify the geographical limits of the North Rupununi Wetlands. In this region there are three main river catchments: the Rupununi River catchment, the Burro Burro/Siparuni River catchment and for the areas that did not drain into the two latter catchments, the Essequibo River catchment. This was a crucial exercise, since any land use change in any of these three regions would probably have impacts on the waterbodies, their ecology and community livelihoods.

The second objective was to compile a series of useful layers for decision making. These included community locations, communication routes, vegetation distribution, flooding extent during different times of the year, and sites of significant ecological/social importance. Much of this information was collected during the two years of monitoring.

A major challenge was to identify a software tool which could capture, host and analyse the spatial information in a way which was relatively straightforward for project partners to use and maintain. A significant addition to the Darwin Project was the granting in August 2005 of £45,000 from the Economic and Social Research Council to develop such a system. This system is currently being developed and tested.

5.2.2.4 Prioritizing and identifying critical thresholds

Once data on the wetland social-ecological indicators was collected and analysed, it was necessary to set critical limits for the indicators i.e. it was important to determine acceptable and desirable limits for them. If the indicator then moved beyond the values specified for it, we would know that remedial action was required to restore system integrity and health. For example, we could set a desirable limit of fish diversity for a wetland type as 10 species and an acceptable limit as 6 species. If fish species diversity fell beneath six then appropriate remedial actions would need to be taken to restore system integrity and maintain important functions, resources and services.

For the North Rupununi ecological system a series of reference 'healthy' waterbodies comprising of a suite of indicators, were developed from the data analyses for the different types of habitat waterbodies (Table 5.5). These waterbody characteristics represent the level and type of ecological functions that should be performed within a 'healthy' system and are outlined in the State of the North Rupununi Report (2006). The setting of thresholds - determining whether certain key functions were being performed to a high degree, performed (existence) or not performed (not viable) - of the ecological indicators came about through the analysis of the data collected. However, it is recognised that there needs to be in-depth consultation with stakeholders on ensuring that there is common agreement on these ecological thresholds. This will be undertaken in the next iteration of the adaptive management learning cycle.

Within the timeframe of this project and the social data collection that took place, it was not possible to collect data on all the indicators of these functions. In addition, although it is relatively straight forward to set health thresholds for ecological systems, social health thresholds are heavily reliant on the values, norms and beliefs of people. For example, what are the acceptable levels of nutrition in the North Rupununi or what is the acceptable proportion of time spent being ill with malaria? Since it is up to the communities to a) decide which indicators are of significance i.e. ranking and prioritising indicators, and b) to decide what the thresholds are, it has only been possible to transform the raw data collected into modes which can support discussions. These are presented in the State of the North Rupununi Wetlands Report (2006) and will form the basis of further discussions with the communities and the establishment of thresholds.

Overall, the data collected indicates that the ecological functions of the North Rupununi wetlands are being performed in the manner in which would be expected for the healthy operation of different waterbody types. The State of the North Rupununi Wetlands Report (2006) also highlights that the communities living in the North Rupununi are still heavily reliant on natural wetland resources for their livelihood support and social functions. In addition, the data suggests that there is significant potential for improving the livelihood support and social functions. For example, although there is a high diversity of animal species of tourism potential, ecotourism activities are still in their infancy within the North Rupununi.

Table 5.5 Functional characteristics for each waterbody type in a 'healthy' ecological system

Waterbody group	Food web support	Habitat maintenance	Floodwater detention	Groundwater recharge	Groundwater discharge	Sediment retention	Nutrient retention	Nutrient export	In situ carbon retention
Savanna ponds that dry out	Function performed to a high degree	Function performed to a high degree	Function performed	Function performed	Function not performed	Function performed	Function not performed	Function not performed	Function performed to a high degree
Savanna permanent ponds	Function performed to a high degree	Function performed to a high degree	Function performed	Function performed	Function not performed	Function performed	Function not performed	Function not performed	Function performed to a high degree
Savanna river associated waterbodies	Function performed to a high degree	Function performed to a high degree	Function not performed	Function not performed	Function not performed	Function not performed	Function not performed	Function not performed	Function not performed
Forest ponds that dry out	Function performed to a high degree	Function performed to a high degree	Function performed to a high degree	Function not performed	Function not performed	Function performed to a high degree	Function not performed	Function not performed	Function performed to a high degree
Forest permanent ponds	Function performed to a high degree	Function performed to a high degree	Function performed to a high degree	Function not performed	Function not performed	Function performed	Function not performed	Function not performed	Function performed to a high degree
Forest river associated waterbodies	Function performed to a high degree	Function performed to a high degree	Function not performed	Function not performed	Function not performed	Function not performed	Function not performed	Function not performed	Function not performed

5.2.2.5 Stakeholder engagement

Engaging with a range of stakeholders with an interest in the North Rupununi wetlands was a core activity in the project (see Table 5.6 for list of stakeholders). This helped to understand who the stakeholders were, their levels of power, their relationships to and with one another, as well as identifying decision-making structures, the processes of decision making and the location of key resource personnel. This was done through a number of ways and included:

1) regular one to one meetings with stakeholders to discuss particular stakeholder issues;
2) a regular project bulletin to keep stakeholders up to date with project activities and outputs;
3) a stakeholder forum which brought together all the stakeholders face to face for a workshop to identify problems and opportunities;
4) an in-depth study to look at institutional structures for wetland biodiversity conservation in Guyana. This was in the form of a Masters thesis by a University of Guyana staff member seconded to the project.

Table 5.6 List of North Rupununi wetlands stakeholders in Guyana that were consulted during the project

North Rupununi District Development Board
Fifteen communities of the North Rupununi
Iwokrama International Centre
Environmental Protection Agency
University of Guyana
Conservation International – Guyana
World Wildlife Fund – Guyana
Wildlife Division – Government of Guyana
Fisheries Division – Government of Guyana
Flora and Fauna International – Guyana
Amerindian Peoples Association
Karanambu Trust
Ministry of Amerindian Affairs – Government of Guyana
Guyana Forestry Commission

One of the main outcomes of these stakeholder consultations was the unanimous agreement between the different stakeholders that the North Rupununi District Development Board (NRDDB) and the local communities should have the central role of management and governance of the wetlands in the North Rupununi. Other stakeholders, such as the Iwokrama International Centre and the Environmental Protection Agency would play a supportive, advisory role. Lack of resources (human, technical and financial) is the main problem for these institutions for the day to day management of the wetlands.

More focused consultations with the NRDDB and local communities identified livelihood sustainability and security, economic activities and increased education and awareness of wetlands as some of the benefits that could come out of the North Rupununi wetlands project and the development of NRAMP. In addition, they identified the need for more information on the wetland social-ecological system such as wetland functioning and land use and ownership. The aspect of education, awareness raising and further capacity building were particular issues identified by all the stakeholders. Boxes 5.1 and 5.2 illustrate the detailed feedback given by the different stakeholder groups.

Box 5.1 Issues raised by Georgetown stakeholders on the NRAMP

Need to identify roles of agencies and various stakeholders in the Rupununi in the NRAMP process.

Need to consider economic gains of the natural resources to the humans, and consider over harvesting of resources.

Need to consider the wider ecosystem services within the Rupununi region and the wider community of the country.

Need to consider business initiatives, National Development Strategies, and the impact of these on the wetland system.

Need to ensure that the plan does not conflict with the PRMU, but rather compliments it.

Need to take into consideration different options and scenarios.

Need to look at resource use availability within the different communities.

Need to look at what resources are available for the implementation of the NRAMP.

Need to ensure that the process of the implementation of this plan is documented well, as this would be the first plan of this nature within the region that can then be used in other regions.

Need for a thorough knowledge of the NRAMP cycle as this is an adaptive plan that will change over time, so the time frame of the iteration of the cycle based on the monitoring components would be important.

Need to capture conflicts, as resource use might overlap or be on opposite ends of the spectrum, so that resolution or common ground can be found.

Need to prepare and capture unexpected events and possible outcomes of these events.

Need to be aware if the plan will cover any legislative aspect and if it would conflict with any.

Needs to ensure that there is a functional management authority for the implementation of NRAMP, whether it is the NRDDB or a new separate group, for example a steering committee which includes the communities via the NRDDB, University of Guyana, Iwokrama, Environmental Protection Agency, Conservation International-Guyana, and other agencies that work within the region, therefore ensuring multiple interests being represented.

Need to ensure that local capacities to implement the NRAMP are built.

Box 5.2 Issues raised by North Rupununi communities and the NRDDB on the NRAMP

This NRAMP decision cycle has the potential of providing a clear system to start the process of better management of the resources in the North Rupununi.

The cycle is also useful for the development of plans for multiple resources – as it not restricted to a particular resource but to general resource management.

For the time period for the reiteration of the cycle – taking more than one year would make it difficult to plan on how to fix or make a situation better and then go about doing it. Situations will change rapidly in the Rupununi and it will be important for us to act rapidly.

Need to know of the commitment of other agencies that have a role in the management of the Rupununi Wetlands and resources towards the NRAMP process.

Need to also know what kind of support is available to assist in the implementation of the NRAMP process.

The proposed outline and features of the NRAMP takes into consideration the importance of natural resource management decisions to be made by different groups collectively rather than as different groups making separate decisions without consultation.

The learning and training component of the NRAMP has a lot of potential for raising awareness on management of wetland resources, and that proper management is finding the balance.

Also, it was highlighted that management of resources is a relatively new term in the North Rupununi, even though there are many cultural practices and beliefs that were designed to aid in the management and use of the resources found in the North Rupununi.

The NRAMP having sustainability as a core principle was also described as appropriate, as the management of resources in every village is centred around sustainable use.

The inclusion of dialogue in the process for developing management strategies for the resources found in the North Rupununi was also seen as an important component of the written version of the NRAMP to foster better understanding of the process.

Need for equipment and training for villagers so that it will be a learning process that benefits the community, as well as by having community members engaging in the process, there will be the added mix of ownership of the resources which in turn will aid in management and sustainability of the resources.

Over the course of the project, the Ministry of Amerindian Affairs has also been involved in developing guidelines for community based natural resource management in the North Rupununi. This has led to the proposed establishment of a natural resources management unit in the North Rupununi called the Payakîîta Resource Management Unit (PRMU) which will be linked to the existing NRDDB by virtue of a shared chair. An important point to note here is that the PRMU specifically focuses on supporting decision making within the titled communities of the North Rupununi. The area covered by these communities is only an extremely small fraction of the North Rupununi Wetlands which includes the catchments of the Rupununi, Burro Burro, Siparuni and Essequibo rivers. Also, there are a much wider range of stakeholders involved in the management of the North Rupununi Wetlands, including non-titled Amerindian communities within the North Rupununi region, Iwokrama International Centre, Karanambo Trust, Conservation International and the communities living in the South Rupununi who can have a significant impact on the Rupununi River downstream if they put into place major land use changes. Thus NRAMP focuses on a much greater scale and greater mix of stakeholders than PRMU. However, all stakeholders, but particularly the NRDDB and local communities recognise the need to coordinate PRMU requirements and outputs with the outputs of the North Rupununi wetland project.

5.2.3 Planning

5.2.2.1 Project conclusions and recommendations

A number of recommendations were made once the project findings were evaluated. These are as follows:

- The North Rupununi is a complex system of waterbodies, habitats, wildlife and human communities and provides a range of social and ecological functions;.
- The social and ecological functions are maintained through a diversity of waterbody types (for example: savanna ponds that dry out; savanna permanent ponds; savanna river associated waterbodies; forest ponds that dry out; forest permanent ponds; and forest river associated waterbodies) and the habitats and wildlife they support.
- The two year monitoring project has concluded that in general the waterbodies studied are functioning in an optimal manner providing important resources and services for people and maintaining a healthy ecosystem (see the State of the Rupununi Report 2006 for more details).
- The communities within the North Rupununi are heavily reliant on natural wetland resources for their livelihood support and social functions. However, the data collected suggests there is significant potential for improving these functions for the people of the North Rupununi.
- To improve livelihood support and social functions, specific livelihood activities can be developed. It is suggested that the NRAMP approach to management is adopted to ensure the maintenance of waterbody, habitat, wildlife and human community diversity and health.
- Through consultation with stakeholders the project has concluded that the health of the North Rupununi Wetland System is likely to come under threat from both internal and external pressures. These pressures need to be recognized, monitored and addressed within future management plans for the system.

5.2.2.2 Planning for the next cycle

Evaluating the data collected as well as the interests of the stakeholders allowed the project to establish goals identified by the stakeholders as the focus for further action. These goals are based on the realisation that although the project helped to collect essential baseline information on the North Rupununi social-ecological wetland system, further information and capacity building was essential if the NRAMP process was to be effectively implemented. The goals set by the stakeholders were the following:

1) to establish thresholds for the social-ecological function indicators identified in the first phase of the project;
2) to significantly expand the number of trained individuals in biodiversity monitoring and management;
3) to develop material for Guyanese university courses and schools to help raise awareness of, and build capacity for, biodiversity conservation (providing the next generation of biodiversity professionals and active conservationists);
4) to develop local financially sustainable livelihood schemes, such as eco-tourism, that have a linked objective to the biodiversity monitoring and conservation of key wetland habitats important to the local communities.

Table 5.7 illustrates the plan developed to achieve the above goals. This is in the form of a log frame.

Table 5.7 Logframe for the second phase of the Darwin Initiative Wetlands Project

Project summary	Measurable indicators	Means of verification	Important assumptions
Goal:			
To draw on expertise relevant to biodiversity from within the United Kingdom to work with local partners in countries rich in biodiversity but poor in resources to achieve · the conservation of biological diversity, · the sustainable use of its components, and · the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources			
Purpose			
Build capacity of stakeholders at both local and national levels in implementing the North Rupununi Adaptive Management Plan (NRAMP) in ways that are ecologically, socially and financially sustainable	New understanding of the impact NRAMP has on ecological sustainability of wetland systems, economic equity, social justice and cultural diversity within the Rupununi region Continued implementation of NRAMP by Guyanese partner organisations Evidence of sustainable management and the maintenance of wetland biodiversity Increased awareness of wetland biodiversity conservation issues at local and national levels Sustainable livelihoods achieved through activities such as eco-tourism	Internal reports from Guyanese partner organisations related to sustainable management of wetland biodiversity Wetland training, monitoring and education programmes adopted by Guyanese organisations Wetland species and habitat monitoring reports from partner organisations Income generated from sustainable livelihoods	All relevant stakeholders willing and able to continue participation in the implementation of NRAMP

Outputs			
1) Community wetland monitoring and eco-tourism course	1a) Course documentation and materials	1a) Feedback from documentation review 1a) 2 copies of course material sent to Darwin Initiative	1) Trained staff remain in communities and train other community members to undertake wetland monitoring and tourist guiding
	1b) 6 trained trainers to implement wider training within local communities 1c) Wetland habitat guides for tourists 1d) 3 Earthwatch expeditions per year	1b) Trainee evaluation questionnaire and attendance records 1c) 2 copies of course material sent to Darwin Initiative 1d) Expedition participant attendance records	
2) Wetland monitoring and management ranger and environment officer training course	2a) Course documentation and materials 2b) 6 trained trainers to implement training of biodiversity conservation NGOs and EPA staff	2a) Feedback from documentation review 2a) 2 copies of course material sent to Darwin Initiative 2b) Trainee evaluation questionnaire and attendance records	2a) Trained staff remain in institutions and train other staff members in wetland monitoring and management 2b) Conservation organisations having a continued commitment to wetland management within the Rupununi
3) Wetland biodiversity primary school teacher and student packs	3) 16 local community school resource packs for teachers and students published	3) Review and feedback on course material at local and national level	3) Continued support from local schools and wildlife clubs for the project
4) Sustainable management of wetland biodiversity university postgraduate course	4) Course lecture material and resources produced	4) Review and feedback on course material within University of Guyana , Open University and Royal Holloway	4) Continued support from the University of Guyana for the project
5) NRAMP Impact Assessment Report	5a) Workshops completed 5b) Report peer reviewed and distributed to all stakeholders	5a) List of attendees 5b) ECOSENSUS database updated 5c) 3D participatory model of Rupununi 5d) 2 copies of report sent to Darwin Initiative	5) All stakeholders attend and participate in workshops
6) Publications, presentations and exhibitions	6) 6 radio and 2 TV broadcasts; 4 newspaper articles; permanent wetland biodiversity exhibitions; 6 quarterly wetland stakeholder bulletins; 2 papers published in peer reviewed journals; Rupununi wetland website	6) Copies of all publications and recordings sent to Darwin Initiative	6)Broadcasts and publications reach and positively influence intended stakeholders

Activities	Activity Milestones (Summary of Project Implementation Timetable)
Stakeholder workshops	Yr1: Start-up workshop – project team to plan work programme and identify key tasks (1wk Jan 07); First stakeholder workshops - assess implementation of NRAMP using ECOSENSUS platform, develop 3D Rupununi model and undertake first iteration of NRAMP impact assessment (4wks Jan/Feb 07); Second stakeholder workshops – second iteration of NRAMP impact assessment (1wk Aug07); Final workshop – third iteration of NRAMP impact assessment and presentation of findings (1wk Feb08)
Training programmes	Training of trainers for community wetland monitoring and eco-tourism course and initiation of course development (1wk Feb07); Training of trainers of wetland monitoring and management ranger and environment officer course and initiation of course development (1wk Feb07). Evaluation and adaptation of training course material (Mar07 to May07) Community wetland monitoring and eco-tourism training programmes (Jun07 to Feb08); Wetland monitoring and management ranger and environment officer training programmes (Jun07 to Feb08).
Wetland biodiversity primary school teacher and student packs	Development of materials (Oct06 to Sep07); First draft, consultation and review (Oct07); Second draft, pilot implementation and evaluat ion (Feb08); Published (Mar08).
Sustainable management of wetland biodiversity university postgraduate course	Development of materials (Oct06 to Sep07); First draft, consultation and review (Oct07); Second draft, pilot implementation and evaluation (Feb08); Published (Mar08).
Publicity material	3 radio and 1 TV broadcasts (per yr); 1 national newspaper article (per yr); 2 UK press releases; permanent wetland biodiversity exhibitions (Feb08); 4 wetland stakeholder bulletins (per yr); 2 papers published in peer reviewed journals (Dec 08); Rupununi wetland website (Feb07 to Nov08); articles within WWT, Royal Holloway and OU publications (Feb 07 to Nov08).

This plan of action includes an explicit reiteration of the process outlined above including making sense of the situation, evaluating the information and developing a new plan of action.

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Appendix

International conventions and Guyanese laws and regulations as relating to natural resource management

CONVENTION ON BIOLOGICAL DIVERSITY (CBD)

The Convention on Biological Diversity (CBD) was inspired by the world community's growing commitment to sustainable development. It represents a dramatic step forward in the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits from the use of genetic resources. The CBD was adopted on 22nd May 1992 and was opened for signature on 5th June 1992. The CBD entered into force on the 29th December. Guyana signed up to the Convention in 1992 and subsequently ratified it two years later.

The Convention on Biodiversity document can be accessed on this website: http://www.biodiv.org/convention/convention.shtml

IMPLICATIONS FOR NRAMP

1. Convention Principle

- States have the, in accordance with the Charter of the United Nations and International law, the sovereign right to exploit their own resources according to their own environmental policies and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states.

2. Measures for Conservation and Sustainable Use

Each party shall in accordance with its particular conditions and capabilities:

- Develop national strategies, plans or programmes for the conservation and sustainable use of biodiversity;
- Integrate as far as possible the conservation and sustainable use of biological diversity into relevant sectoral or cross-sectoral plans, programmes and policies.

3. Identification and Monitoring

Each contracting party shall:

- Identify components of biological diversity important for its conservation and sustainable use;
- Monitor, through sampling and other techniques, the components of biological diversity;
- Identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects through sampling and other techniques;
- Maintain and organize, by any mechanism data, derived from identification and monitoring activities.

4. In-Situ Conservation

Each contracting party shall as far as possible:

- Promote the protection of ecosystems, natural habitats and the maintenance of viable (feasible, practical) populations of species in natural surroundings;
- Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas;

- Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional; life styles relevant for conservation and sustainable use of biological diversity and promote their wider application with the approval and the involvement of the holders of such knowledge, innovations and practices and encourage equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices;
- Develop or maintain necessary legislation and/or regulatory provisions for the protection of threatened species and populations.

5. Sustainable use of Components of Biological Diversity
Each contracting party shall as far as possible:

- Integrate consideration of the conservation and sustainable use of biological resources into national decision-making;
- Adopt measures relating to the use of biological resources to avoid or minimize adverse impacts on biological diversity.

6. Public Education and Awareness
Each contracting party shall:

- Promote and encourage the understanding of the importance of, and the measures required for, the conservation of biological diversity, as well as its propagation through media, and the inclusion of these topics in educational programmes;
- Cooperate with other States and International organizations in developing educational and public awareness programmes, with respect to conservation and sustainable use of biological diversity.

RAMSAR CONVENTION ON WETLANDS

The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. Up to 2008, the government of Guyana had still not signed up to this treaty.

The Convention on Wetlands documents can be accessed on this website: http://www.ramsar.org/

IMPLICATIONS FOR NRAMP

Article 1

For the purpose of this Convention:

- Wetlands are areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres.
- Waterfowl are birds ecologically dependent on wetlands.

Article 2

Each Contracting Party shall:

- Designate suitable wetlands within its territory for inclusion in a List of Wetlands of International Importance, hereinafter referred to as "the List" which is maintained by the bureau established under Article 8. The boundaries of each wetland shall be precisely

described and also delimited on a map and they may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands, especially where these have importance as waterfowl habitat.

- Designate at least one wetland to be included in the List when signing this Convention or when depositing its instrument of ratification or accession, as provided in Article 9.

Article 3

The Contracting Parties shall formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory.

Article 4

Each Contracting Party shall promote the conservation of wetlands and waterfowl by establishing nature reserves on wetlands, whether they are included in the List or not, and provide adequately for their wardening.

Where a Contracting Party in its urgent national interest, deletes or restricts the boundaries of a wetland included in the List, it should as far as possible compensate for any loss of wetland resources, and in particular it should create additional nature reserves for waterfowl and for the protection, either in the same area or elsewhere, of an adequate portion of the original habitat.

The Contracting Parties shall encourage research and the exchange of data and publications regarding wetlands and their flora and fauna.

The Contracting Parties shall endeavour through management to increase waterfowl populations on appropriate wetlands.

The Contracting Parties shall promote the training of personnel competent in the fields of wetland research, management and wardening.

WILD BIRDS PROTECTION ACT

This Act may be cited as the Wild Birds Protection Act and came into operation when enacted by the Parliament of Guyana 30th September 1919. This Act can be accessed in this website: www.gina.gov.gy/gina_pub/laws/tableofcontents.pdf

This Act will provide for the protection of certain Wild Birds. In this Act:

- "The close season" means the period or periods specified in the third schedule as amended from time to time by order of the Minister;
- "Wild bird" means any bird specified in the First or the second Schedule.

IMPLICATIONS FOR NRAMP

1. Wounding, capturing or killing wild birds specified in the First Schedule Anyone who:

- Knowingly wounds, or kills, any wild bird specified in the First Schedule;
- Or exposes or offers for sale or exports or attempts to export from Guyana, any wild birds

or part of any wild bird captured or killed after the commencement of the Act shall be liable to a fine.

2. Protection of Captive Birds

- Notwithstanding anything in this Act, no one shall be liable to be convicted of any offence for wounding, or killing, any wild bird if he can prove that the wild bird in respect of which the offence is alleged to have been committed was wounded, or killed for the purpose of procuring food, and at a spot distant more than ten miles from any plantation.
- No Amerindian shall be liable to be convicted of any offence under this Act.
- Notwithstanding anything in this Act, the Minister may, for the time and subject to the conditions he thinks fit, authorizes any person to kill wild birds, and may also so authorize any person tot export wild birds or the skins of wild birds.

AMERINDIAN ACT 2006

This Act may be cited as the Amerindian Act 2006 and came into operation ? This Act seeks to provide the recognition and protection of the collective rights of Amerindian communities, the granting of land to Amerindian Communities and the promotion of good governance within the Amerindian Communities.

This Act can be accessed through the Ministry of Amerindian Affairs, 251-252 Quamina & Thomas Sts, South Cummingsburgh, Georgetown, Guyana.

In this Act "Community Lands" means lands owned communally by a Community under title granted to a Village Council to hold for the benefit of the Community.

IMPLICATIONS FOR NRAMP

1. Entry and Access: Scientific and other Research (Sec 5)

A person who wishes to conduct any scientific, anthropological, archaeological or other research or study within community lands shall apply for and obtain in advance:

- The permission of the village council;
- All permits required under any other written law;
- The permission of the Minister.

2. Functions of Village Councils (Sec 13)

Functions include:

- Manage and regulate the use and occupation of Community Lands;
- Promote the sustainable use, protection and conservation of Community lands and the resources on those lands.

3. Powers of Village Council to make rules (Sec 14)

Subject to the other provisions of this Act, a Village Council may, in the exercise of its functions, make rules governing:

- Occupation and use of Community lands;
- The protection and sustainable management of wildlife including restrictions on hunting, fishing, trapping, poisoning, setting fires and other interference with wildlife;
- The control, maintenance, protection and use of water supplies.

4. Mining (Sec 48)

1. A miner who wishes to carry out mining activities on Community Lands or in any river, creek, stream or other source of water boundaries of Community Lands shall:

- Obtain any necessary permissions and comply with the requirements of the applicable written laws;
- Give community a summary of proposed mining activities: summary should include likely impacts of the activities on the Community.

2. A miner who receives the Community's consent shall enter into a written agreement with the village Council on behalf of the Community. An agreement would implied: The miner shall take all reasonable steps to avoid:

- Damage to the environment;
- Pollution of ground water and surface water;
- Damage to or disruption of flora and fauna.

5. Use of forest produce by Residents (Sec 54)

- A resident who wishes to use forest produce from the Community lands shall obtain the permission of the Village Council and comply with any conditions attached to that permission.

6. Use of forest produce by Non-Residents (Sec 55)

A person, other than a person referred to in Section 54, who wishes to use forest produce from Community lands shall:

- Send a written notice containing detailed description of the proposed activity to the Village council, Minister, the Guyana Forestry Commission and the Environmental Protection Agency.

7. Obligations of Guyana Forestry Commission (Sec 56)

If the Guyana Forestry Commission intends to issue a permit, concession, licence, timber sales agreement or other permission in respect of any State forest which are contiguous with the Community Lands the Guyana Forestry Commission shall first consider the impact on the Community.

GUYANA TOURISM AUTHORITY ACT

This Act may be cited s the Guyana Tourism Authority Act 2002, and came into operation when enacted by the Parliament of Guyana 2002.

This Act can be accessed on this website: www.gina.gov.gy/gina_pub/laws/tableofcontents.pdf

This Act will provide for the:

- The incorporation of the Authority;
- To define its functions;
- For matters connected therewith.

IMPLICATIONS FOR NRAMP

1. Functions of the Authority:

- To promote the development of the tourism industry;
- Promote throughout Guyana awareness on the implications, importance and benefits of tourism;
- Advise and recommend integrated, complementary, sustainable land use practices and environmental strategies for the development of tourism facilities in Guyana.

2. Licence of Tourism Business

- No person shall operate any tourism business except under, and in accordance with a licence issued by the Authority.

GUYANA FORESTRY COMMISSION ACT

This Act may be cited as the Guyana Forestry Commission Act and came into operation when it was enacted in the Parliament of Guyana on the 18th January, 1979.

This Act can be accessed on this website: www.gina.gov.gy/gina_pub/laws/tableofcontents.pdf

This Act will seek to provide

- The establishment and the function of the Guyana Forestry Commission and for the purposes connected therewith.

IMPLICATIONS FOR NRAMP

1. Establishment of the Guyana Forestry Commission (Sec 3)

The function of the commission shall include:

- To formulate, advise the Government on, and implement the forest policy of the Government as determined by the Government;
- To identify, establish, maintain and manage forests, including national parks, wildlife areas and nature reserves, for the purpose of production, protection of the environment, education, recreation, the provision of amenities, and matters of scientific, historic or special value;
- To assist in the prevention and control of forest fires, pollution of the environment, erosion or soil, diseases and destruction of flora and fauna.

IWOKRAMA INTERNATIONAL CENTRE FOR RAIN FOREST CONSERVATION AND DEVELOPMENT ACT

This Act may be cited as the Iwokrama International Centre for Rain Forest Conservation and Development Act and came into operation when it was enacted by the Parliament of Guyana on the 7th May 1996.

This Act can be accessed on the following website: www.gina.gov.gy/gina_pub/laws/tableofcontents.pdf

This Act will provide for:

- The sustainable management and utilization of approximately 360,000 hectares of Guyana's Tropical Rain Forest dedicated by the Government of Guyana as the Programme Site for the purposes of research by the Iwokrama International Centre;
- To develop, demonstrate and make available to Guyana and the international community systems, methods and techniques for the sustainable management and utilization of the multiple resources of the Tropical Forest and conservation of biological diversity.

IMPLICATIONS FOR NRAMP

1. Control of Programme Site (Sec 5)

- Subject to the provisions of this Act, the Programme Site, with the exception of such areas as may be needed for the corridor for the Surama-Kurupukari stretch of the Lethem-Mabura Hill road passing through the Programme Site, shall be under the control of the Centre whose authority over the Programme Site shall, in so far as it relates to the Programme and the functions of the Centre, be deferred to by any other person or authority notwithstanding any other written law;
- Provided that the Centre shall be responsible for the management or control of such areas of the Programme Site as the Government may, after consultation with the centre, determined to be required for the corridor for the Surama-Kurupukari stretch of the Lethem-Mabura Hill road passing through the Programme Site.;
- No mining, forestry or other resources utilization activity shall be carried out on the Programme Site by any other person than the Centre, except with the prior written permission of the Centre;
- No lease of land or permission to use land in the Programme Site shall be issued by any person other than the Centre, and all activities on the Programme Site shall be in accordance with regulations prescribed therefore under this Act.

2. Protection of Amerindian Rights (Sec 6)

- Nothing in this Act shall be construed to prejudice, alter or affect any right or privilege heretofore legally or traditionally possessed, exercised or enjoyed by any Amerindian who has a particular connection with any area of land within or neighbouring the Programme Site.

3. Demarcation of Programme Site into Areas (Sec 7)

- The Centre shall demarcate and allocate portions of the Programme Site into the following areas and shall by notice publish such demarcation in the Gazette:
  (a) Areas for the establishment and maintenance of the Rain Forest Wilderness Preserve;
  (b) Areas for the sustainable utilization of the multiple resources of the tropical rain forest.

4. Management of Demarcated area (Sec 9)

- The Centre may grant permission for the utilisation of the resources within the areas demarcated for the sustainable utilization of the multiple resources of the tropical rain forest.

5. Core Programmes of the Iwokrama International Centre (Article 5)

- Sustainable management of the tropical rain forest;
- Conservation and utilization of biological diversity;
- Forestry research;
- Sustainable human development;
- Information and communication.

6. Main activities and functions of the Iwokrama International Centre(Article 6)

- Demonstrate that tropical rain forests can maintain biological diversity while supporting economic activity.

7. Rights in Discoveries, Inventions and Improvements(Article 8)

- The Centre shall develop and adopt procedures for recognizing and rewarding the contributions of Amerindian and other rural communities in the conservation and improvement of genetic resources or economically useful plant and animal species.

ENVIRONMENTAL PROTECTION ACT

This Act may be cited as the Environmental Protection Act 1996 and came into operation when it was enacted by the Parliament of Guyana on the 6th of May 1996. Since then an amendment has been made in 2005 and a regulation under section 68.

This Act can be accessed at this website:

www.gina.gov.gy/gina_pub/laws/tableofcontents.pdf

This Act will provide for:

- The management, conservation, protection and improvement of the environment;
- The prevention or control of pollution;
- The assessment of the impact of economic development on the environment;
- The sustainable use of natural resources.

In this Act

- " Agency means the Environmental Protection Agency"

IMPLICATIONS FOR NRAMP

1. Functions of Agency (Sec 4)

a. The functions of the Agency includes (Sec 4):

- Take steps that are necessary for the effective management of the natural environment so as to ensure conservation, protection and sustainable use of its natural resources;
- To co-ordinate and maintain a programme for the conservation of biological diversity and its sustainable use;
- To establish and co-ordinate institutional linkages locally, nationally, regionally and internationally.

b. In the exercise of its functions the Agency may:

- Monitor and co-ordinate monitoring of trends in the use of natural resources and their impact on the environment.

2. Mischellaneous

The Minister may make regulations for the purpose of giving effect to the provisions of this Act. Such regulations may contain provisions in relation to:

- The protection of particular species of prescribed fauna and flora;
- Protecting the coastal and marine resources;
- The principles to facilitate the participation of communities which are likely to be adversely affected by the activity of a developer, taking into account the rights of indigenous communities.

FOREST ACT

This Act may be cited as the Forest Act and it came into operation when it was enacted by The Parliament of Guyana on 2nd May, 1953.

This Act can be accessed on this website: www.gina.gov.gy/gina_pub/laws/tableofcontents.pdf

This Act would provide for the "Consolidation and amendment of the Law relating to forests".

IMPLICATIONS FOR NRAMP

1. State Forests (Sec 3)

- The Minster may by order declare any area of State land to be a State forest and may, from time to time, vary or revoke such order.

1. Ownership of Forest Produce(Sec 14)

- All forest produce from State forests shall remain the property on the State until the prescribed royalty thereon has been paid.

2. Precautions against Fire(Sec 17)

- No person shall in any State forest negligently light or throw down any match or other lighted or inflammable material, or light or leave any fire without taking due precautions against the fire spreading or causing injury, or do anything in consequence of which any forest produce may be burnt or injured, or may be in danger of being burnt or injured.

3. Offences and Legal Proceedings(Sec 20)

- Everyone who trespasses on or lawfully occupies any State forest shall be liable to a fine of four thousand five hundred dollars or to imprisonment for four months.

4. Protection of Rights of Amerindians(Sec 39)

- Nothing in this Act shall be construed to prejudice, alter, or affect any right or privilege heretofore legally possessed, exercised, or enjoyed by any Amerindian in Guyana.
- Provided that the Minister from time to time by publication in the Gazette may make any regulations to him seeming meet defining the privileges and rights to be enjoyed by Amerindians in relation to the State forests.

WATER AND SEWERAGE ACT

This Act may be cited as the Water and Sewerage Act 2002 and came into operation when enacted by the Parliament of Guyana 2002.

This Act can be accessed on this website: www.gina.gov.gy/gina_pub/laws/tableofcontents.pdf

This Act will provide for the:

- Ownership, management, control, protection and conservation of water resources;
- Provision of safe water, sewerage services and advisory services.

IMPLICATIONS FOR NRAMP

1. Ownership and Use of Water (Sec 18)

- The ownership of all water resources and the rights to use, abstract and manage and control the flow of water are vested in the State;
- All existing rights to own, use, abstract, manage and control the flow of water are hereby saved upon the terms of their grant or other lawful authority under which they are held.

2. Users of Surface Water (Sec 20)

- No person shall divert or abstract surface water in an amount which exceeds that prescribed by regulations unless such diversions or abstraction is authorized by a valid licenced or by law.

3. Saving of Existing Rights (Sec 94)

- All land occupied or used by an Amerindian Community and all land necessary for the quiet enjoyment by the Amerindians of any

Amerindian settlement shall be deemed to be lawfully occupied by them.

MINING ACT

This Act may be cited as the Mining Act and came into operation when it was enacted by the Parliament of Guyana on the 15th July 1991.

This Act can be accessed on this website:

www.gina.gov.gy/gina_pub/laws/tableofcontents.pdf

This Act will

- Make provisions with respect to prospecting for mining of metals, minerals and precious stones;
- For regulating their conveyance and for matters connected therewith.

IMPLICATIONS FOR NRAMP

1. Mining districts

The minister may, by notice published in the Gazette and in at least one newspaper having circulation I Guyana, constitute any portion of Guyana as a mining district.

2. Rights of State Minerals

- Subject to the other provisions of this Part, all minerals within the lands of Guyana shall vest in the State.
- The Commission may, with the approval of the Minister and subject to section 8, grant a licence or permit under this Act authorizing the holder of the licence to enter on private lands and there search or mine for, take and appropriate, any mineral.

3. Guardianship of Minerals

Subject to the provisions of this Act, the commission shall have the charge of, and act as guardian over, all minerals in the lands of Guyana.

FISHERIES ACT

This Act may be cited as the Fisheries Act 2002 and came into operation when it was enacted by the Parliament of Guyana in 2002.

This Act can be accessed at the following address:

Ministry of Fisheries, Crops and Livestock, 18 Brickdam, Stabroek, Georgetown, Guyana, South America tel: (592) 225-9559; fax: (592) 225-9551

This Act will provide for:

- The promotion, management and development of Fisheries and for matters connected therewith;
- Ensure optimum utilization of fisheries resources in the fisheries waters for the benefit of Guyana;
- Promote precautionary approaches to fisheries management;
- Conservation of fisheries for future generations.

In this Act, "Fisheries waters" means the territorial sea, the exclusive economic zone, the fishery zone and all internal waters as defined in the Maritime Boundaries Act 1977 and such other waters in respect of which Guyana exercises jurisdiction for fisheries purposes.

IMPLICATIONS FOR NRAMP

1. Fisheries Plans (Sec 5)

- The Chief Fisheries Officer shall progressively prepare and keep under review plans for the management and development of significant exploitable fisheries in the fisheries waters.

2. Commercial Fisher's Licences (Sec 14)

- No person shall fish in the fisheries waters without a valid commercial fisher's licences.

3. Controls over the sale of fish taken in course of sport fishing of fisheries related research and survey

operations (Sec 23)

- No fish taken in the course of sport fishing of fisheries related research and survey operations shall be sold except with the prior authorization of the Chief Fisheries Officer.

4. Fisheries related research and survey operations (Sec 24)

- No person shall undertake fisheries related research and survey operations in the fisheries waters except with the prior permission of the Minister.

5. Fishing Priority Areas (Sec 28)

- The minister may by order declare any area of the fisheries waters to be a fishing priority area.

6. Import and Export of Fish (Sec 47)

- No person shall import into Guyana or export or bring to any place for export any fish without obtaining a licence for that purpose from the Chief fisheries officer.

SPECIES PROTECTION REGULATIONS

These Regulations may be cited as the Species Protection Regulations 1999 and is a regulation made under the Environmental Protection Act 1996 (Sec 68). This Regulation was published by the Authority of the Government in the Official Gazette on Wednesday 29th September, 1999.

This Regulation Document can be accessed at the following address:

Environmental Protection Agency, Natural Resource Management Division, 263 Earl's Avenue, Subryanville Tel. 592-225-6048

This regulation seeks to provide

- Protection of particular species of prescribed flora and fauna.

In this Regulation

- "Management Authority" means the management authority designated by the Minister.
- "Scientific Authority means the scientific authority nominated by the Management Authority.

IMPLICATIONS FOR NRAMP

1. Functions of Management Authority (Sec 5)

The functions of the managing Authority shall include:

- Taking such steps as are necessary for the protection of endangered species or animas and plants against over-exploitation through importation and exportation;
- Devising measures to prevent trade in or possession of specimens specified in Schedule I, II, III, and IV in violation of these regulations.

2. Requirement for Permit (Sec 8)

- No person shall import, export, re-export or introduce from the sea, any specimen of an

endangered species of wild animal or plant including animals bred in captivity and artificially propagated species specified in schedule I, II, III, or IV except with a permit or certificate in accordance with the provisions of these regulations.

3. Grounds for refusal to grant permit or certificate (Sec 16)

The Management Authority may refuse to grant a permit or certificate under these regulations, where it has reasons to believe,

- Where in the opinion of the Scientific Authority, the issue of the permit or certificate would not be in the best interest of Guyana, having regard to such factors as the scientific Authority considers relevant including:

1) The need for the protection of certain species of wild animal or plant from over-exploitation through international trade;
2) The preservation of the character of the environment, including animals and plants.

4. License to Trap or Deal in Animals on Commercial Basis (Sec 28)

- Any person who proposes to engage in activities to trap or deal in animals' on a commercial basis shall, before commencing such activities, apply to the Management Authority for a commercial license.

5. Possession of animal or plant (Sec 60)

- No person shall, subject to any other law, possess any animal or plant specified in Schedule I, II, III, or IV imported into Guyana or exported or re-exported from Guyana contrary to the provisions of these regulations.

WILDLIFE MANAGEMENT AND CONSERVATION REGULATION 2000 (NOT LEGAL)

These Regulations may be cited as the Environmental Protection (Wildlife Management and Conservation) Regulations 2000. This is a Regulation made under the Environmental Protection Act 1996 and is still in draft.

This Regulation Document can be accessed at the following address:

Environmental Protection Agency, Natural Resource Management Division, 263 Earl's Avenue, Subryanville Tel. 592-225-6048

This regulation seeks to provide protection of particular species of prescribed flora and fauna.

In this Regulation the

- "Management Authority' means the Management Authority established under the Species Protection Regulations 1999.
- "Scientific Authority" mans the Scientific Authority established under the Species Protection Regulations 1999.
- " Agency" means the Environmental Protection Agency established under the Environmental Protection Act, 1996
- " Exotic Wildlife or Exotic Species" means any species that is not native to Guyana,

IMPLICATIONS FOR NRAMP

1. Functions of the Agency(Sec 3)

The Agency shall be responsible for the administration of these Regulations and functions shall include:

- Encourage public education and awareness programmes relevant to the conservation of wildlife;
- Promote cooperation with any agency of any country, international organizations, regional, national or other person or entity in matters relating to the conservation of wildlife;
- Monitor the compliance of the Government with regional and international obligations relating to wildlife conservation.

2. Declaration of Closed Season (Sec 20)

- The minister may from time to time by notice published in the Gazette, declare a close season or an open season in respect of wildlife and place such restrictions on either the taking or the disposal or the taking and disposal of such wildlife as he considers necessary.
- The minister may from time to time by notice published in the Gazette, declare that any wildlife specified in the notice is for the purposes of these Regulations, wildlife which is likely to become extinct, or is rare, or otherwise in need of special protection and while such declaration is in operation such wildlife is protected throughout the whole of Guyana at all times.

3. Wildlife Harvesting Licence (Sec 21)

- Upon application to the agency a person may be issued, subject to such terms and conditions specified in the licence, a Wildlife Harvesting Licence that would permit the holder of such licence to harvest wildlife.
- A person shall not harvest wildlife in a classified area at any time or in a forest reserve during a closed season.

4. Special Wildlife Licence

The Agency may, for such time and subject to such conditions as it thinks fit, grant a special wildlife licence which shall entitle the holder to hunt, keep or confine in activity any animal specified therein for any of the following purposes:

- Scientific research;
- Collection of specimen for zoological parks or gardens, museums and similar institutions;
- Any other purpose that the Agency may deem appropriate.

5. Selling Wildlife (Sec 26)

- No person shall sell, expose for sale, possess or offer for sale wildlife except in accordance with the terms and conditions of a Commercial Licence issued by the Agency.

6. Exception in respect of Amerindians (Sec 27)

- The Minister may, in order to ensure the continuance of the traditional pursuits of Amerindians, exempt any Amerindian or group of Amerindians from the provisions of these Regulations relating to the harvesting of wildlife or the keeping or confining of any animal in captivity.

- Where the minister grants the exemption to any Amerindian or group of Amerindians it shall be an implied condition in such exemption the such Amerindians shall not use wildlife for any other purpose other than that of subsistence or medicinal purposes or such other purposes as the Minister may specify.

7. Exotic Wildlife (Sec 51)

- A person may harvest exotic wildlife without a licence in any place at any time, except at any time in a classified area or a forest reserve.

ARAPAIMA MANAGEMENT PLAN

This plan was approved by the Guyanese Cabinet on April 20th 2007 for the management of the Arapaima (*Arapaima gigas*) in the North Rupununi, under the Fisheries Act (2002).

This Plan can be accessed at the following site:

www.iwokrama.org/library/pdfdownload/arapaima_management_plan_finalversion.pdf

IMPLICATIONS FOR NRAMP

The Plan will allow the sustainable harvesting of Arapaima as well as regular monitoring of stocks.

PIYAKITA RESOURCE MANAGEMENT UNIT (PRMU)

This document shall be known as the North Rupununi Natural Resource Mangement By-Laws and be recognized as having all the necessary authority of a District and Village according to the Amerindian Act of Guyana as required for the proper implementation of these guidelines.

This document can be accessed at the follow address: Ministry of Amerindian Affairs, Quamina and Thomas Sts, North Cummingsburg, Georgetown

Specific responsibilities of the PRMU shall include, but may not be limited to, the following:

- Conserving natural resources and protecting the region's land, air, water, and biodiversity for the enjoyment and use of future generations;
- Development and implementation of plans and strategies;
- Overseeing the allocation and enforcement of permits;
- Monitoring and conserving natural resources;
- Prioritizing the use, allocation, and conservation of natural resources;
- Facilitating improvement of local natural resource management capacity; and,
- Any other action as described within this document.

IMPLICATIONS FOR NRAMP

ARTICLE 3: INSTITUTIONS

1. Annual Report :

- The PRMU shall draft an annual "State of the Community's Resources, to be completed my October 15th of each year.

2. Regulatory Agency

- The PRMU shall maintain a strictly regulatory role and shall not engage directly in any natural resource utilization scheme, including, but not limited to, tourism, mining, forestry, livestock production and/or agriculture.

3. Village Environmental Officers

a. Each village shall appoint a minimum of one (1) Village Environmental Officer (VEO) in a manner consistent with this document.

b. Responsibilities of the VEO includes, but not limited to:

- Assisting the Toshao with law enforcement;
- Conducting natural resource inventory and monitoring;
- Allocation of Community Resource Use Permits according to the direction of the PRMU; and,
- Assist with the development and implementation of plans and strategies.

ARTICLE 4: RESOURCE MANAGEMENT

1. Community Natural Resources Management Plan

a. Purpose and Contents

- By November 15 of each year, the PRMU shall develop and adopt a "Community Natural Resources

Management Plan" to detail strategic protection and utilization of the represented community's resources.

The Plan shall as much as possible describe current and proposed natural resource management activity, including, but not limited to, the following:

- Inventory and description of natural resource use, including land, water, and biodiversity;
- Identification of ecological status, challenges, opportunities, proposed actions and responsible parties, including research and management priorities;
- Proposed methods to regulate natural resource access, use and protection, including prioritization of resource allocation;
- Complete description of boundaries under jurisdiction of community, including an identification and description of natural resource conservation zones;
- Regulations for the use and management of species, including harvest methods, limits, seasons, and locations;
- Regulatory guidance for the allocation, use, monitoring and enforcement of community and commercial permits, including harvest quotas, decision-making procedures, and tourism management and development guidelines; Identification of capacity needs and related capacity building programs, including public awareness, education, and training related to natural resource management.

As deemed necessary by the PRMU, the Plan may include subsidiary plans for:

- Species and Habitat Management, including wetlands; and,
- Tourism and Management of Sustainable Economic Development.

2. Resource Use Quotas

As deemed necessary to uphold the principles of this document, the PRMU may establish a resource use quota for inclusion within the Community Conservation Plan.

- Each quota shall define the total amount of a resource type that may be harvested in a specific natural resource zone during a particular time period.
- The resource use quota shall be used to guide commercial and subsistence use of resources in the region, including the issuance of permits.
- The use quota shall be based upon the Village Summaries, resource inventories, research activity, best available science, traditional knowledge and other germane information.

3. Natural Resource Protection and Use Zones

a. Establishment:

- The PRMU shall, within one (1) year of the enactment of this document, detail the boundaries of Natural Resource Use Zones.

b. Purpose

- Zone designation shall be based upon the ecological and socio-economic needs of the North Rupununi and the principles of this document.

4. Community Resource Use Permit

a. Requirement

- The PRMU may require persons to secure a "Community Resource Use Permit" (CRUP) from an appropriate Village Council prior to the harvest of any natural resource, including, but not limited to, hunting, fishing, flora collection, and/or tree harvest by groups or individuals.
- The PRMU shall require persons to secure a CRUP from the appropriate Village Council as necessary to maintain the North Rupununi's ecological integrity, including the conservation and survival of particular species and/or ecosystems at risk of over-exploitation.
- The Community Resource Management Plan shall specify those activities requiring Community Resource Use Permits.

b. Non-Community Member CRUPs

- Any non-community member harvesting natural resources for any reason shall secure a CRUP from the Village Council prior to commencing harvest activities.

5. Commercial Resource Permits

- All persons shall secure a "Commercial Resource Permit" from the appropriate Village Council prior to harvesting, utilizing or disturbing any natural resource for commercial purposes.

6 .Flora and Fauna Management

Species Status

- The PRMU shall be responsible for monitoring the health of the region's ecological systems as well determining the status of individual species of flora and fauna.

Species Listing

- The PRMU shall, within the Plan, detail listing procedures and critical indicators to be used to identify the status of individual species.
- These listing procedures shall include reference to relevant Guyanese law as well as international models, including CITES.
- Species lists shall be used to inform both licensing and permitting activities and may include the designation of game species requiring a permit prior to harvest.

Regional Listings

- The PRMU shall have the authority to make listing determinations more stringent than those found in Guyanese Law.

Recovery Strategy

- If the PRMU finds that a species is at significant risk of extinction throughout all or part of the North Rupununi, the PRMU and it's agents shall:

Harvest Management

- The PRMU shall have the authority to draft regulatory guidelines for inclusion within the Plan to manage methods of harvesting flora and fauna. This authority shall include, but is not limited to, regulating:
- The use of firearms, bait, explosives, poison, snares, lines, nets, pits, vehicles, motors, bow and arrow, spear and any other tool or conveyance used for the harvest of wild species; and,
- The seasons, dates, times, and locations of allowed and not allowed harvest for particular species and classes of species.