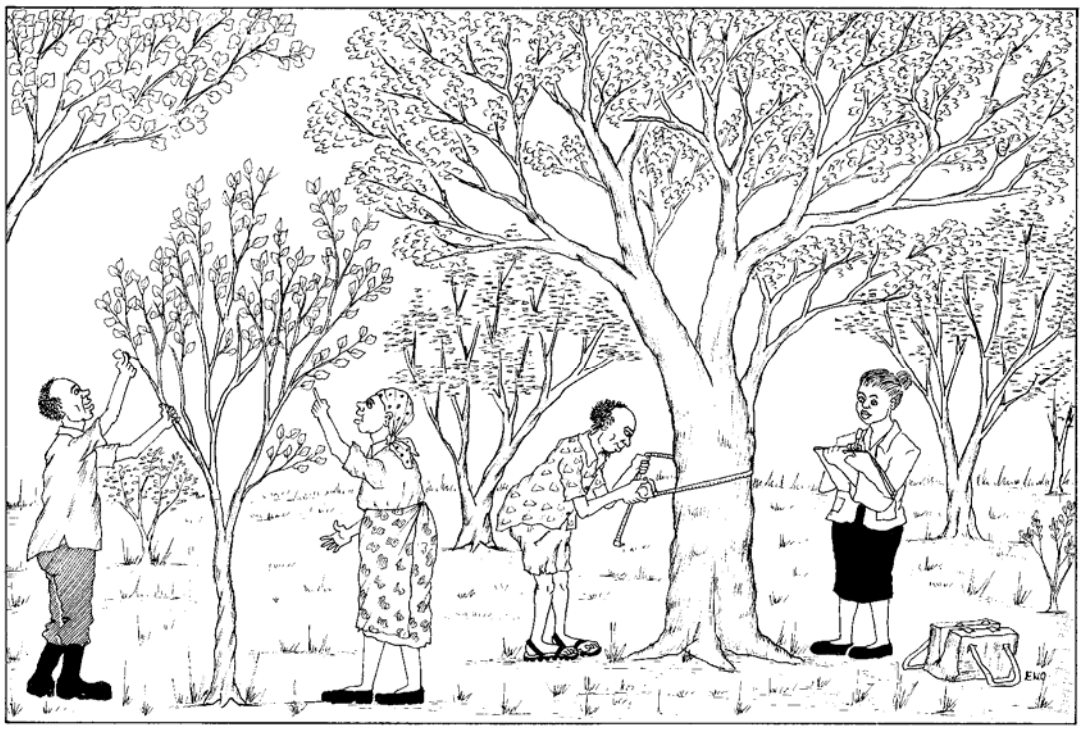
Community-based ecological monitoring

Manual for practitioners



by

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CONTENT

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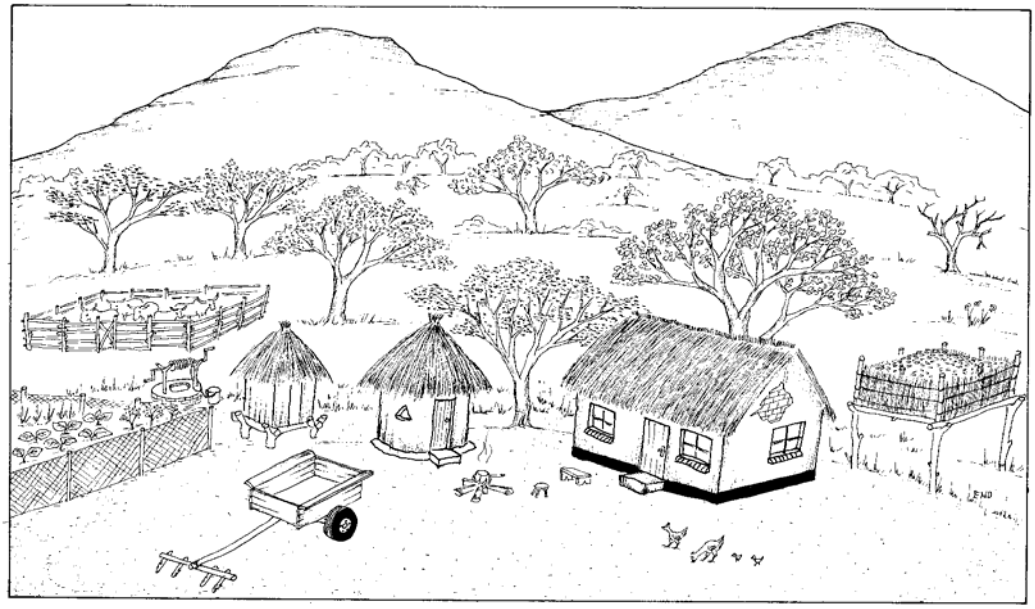
1. Introduction

For most of the people in rural areas of developing countries, **life depends directly on the environment** which surrounds them. Features of the environment such as climate, soil and trees, determine the availability of land use options. People and their action influence the natural resources which can be used and impact on their quality and quantity. Most activities undertaken in rural area such as agriculture, livestock husbandry or even the construction of houses or roads influence the environment, positively or negatively. If negative impacts of the activities are not recognized at an early point of time, they can over the long run lead to serious effects and can destroy the base of livelihoods activities in the rural areas. For instance, if too many fruits of a specific tree are harvested, there will be no fruits left on the ground and eventually no new plants will grow to replace those getting old.



Ever since, people in rural areas are used to **observing the environment**. They look at the frequency and quantity of rainfall, the conditions of the leaves on trees which they want to harvest or the colour of the soil. From these observations, they determine the best way for their action. For instance, they either decide to continue their way of practicing agriculture or using forest products or they start doing things differently. However, with rapidly changing environmental and social conditions, these traditional ways of observing the environment are often not sufficient anymore to prevent overuse.

The process of continuous observation of the environment and adaptation of action is at the core of **ecological monitoring** which is the issue of this manual. Ecological monitoring is not meant to limit the use of natural resources and to limit options for development but is a way of wise long-term development planning. It is a pre-requisite for adaptive natural resource and ecosystem

management. Ecological monitoring approaches can range from purely scientific to very participatory ways of set up of implementation. We have chosen a participatory community-based approach, where the monitoring activities are carried out by the resource users themselves. It emanates from their informal observations of the environment, acknowledges their expertise on environmental trends in their villages and critical issues and uses their traditional ecological knowledge. Community-base monitoring can be carried out in many different settings and even with very restricted funds.

The methodology described in this manual was developed in the context of the work of **SAFIRE** (Southern Alliance for Indigenous Resources), a non-governmental organisation which implements benefit-driven natural resource management in rural areas of Zimbabwe and Zambia. In SAFIRE, a two-year process was conducted to develop an ecological monitoring tool which would be adapted to the needs of both resource users and field staff. With this manual, we want to support the usage of our experiences in Zimbabwe and worldwide.

In order to make the information as useful as possible, this manual contains **the following chapters**:

Name of chapter	Information contained
What is ecological monitoring ?	Basic definitions and technical introductions
Why ecological monitoring ?	Reasons for engaging in ecological monitoring, chances and challenges
What is the basic idea behind ecological monitoring ?	The adaptation cycle and basic steps of any ecological monitoring framework
Why community-based monitoring and how ?	Differences in monitoring approaches and reasons for choosing our community-based approach
Why ecological monitoring for the use of non-timber forest resources ?	Introduction into the technical background for which we have developed this instrument
Which steps to take ?	The core of this manual: how to run a community-based ecological monitoring process
What are our guiding principles and experiences ?	Some further ideas behind our systems and experiences
What else to keep in mind ?	Hints which might prove valuable in the implementation process
Further readings	Where to find more information, from manuals to scientific texts on ecological monitoring, also contains references used for this manual
SAFIRE and ecological monitoring	The organisation behind this manual
Authors	The people behind this manual

In order to make the reading easier, we have not included references in the text. However, all references which were used in the context of the preparation of this manual are listed in chapter 8.

Any comments and questions are welcomed by the authors. You find our e-mail addresses at the end of this manual.

2. What is ecological monitoring ?

In the past years, the use of different **monitoring** approaches has become very popular in development projects and international cooperation. Monitoring can be described as a repetitive observation of phenomena within a certain framework of time and place. In the context of development organisations monitoring often relates to changes in a certain area due to activities carried out by the community, governmental or non-governmental institutions and is meant to support decisions on future steps.

The idea behind **ecological monitoring** is very closely linked to this notion. Ecological monitoring can be understood as the collection, analysis and interpretation of data on the natural environment, above all on changes that occur in a certain ecosystem. It attempts to observe living and non-living aspects of the biosphere, the response of the environment to human interventions and to predict the actual or likely impacts. Accordingly, it helps understanding processes in the environment and can serve as an "early warning" system. It enables project implementers and target groups, e. g. villagers, to recognise negative ecological effects of their activities at an early stage and to adapt their action.

Recently, ecological monitoring became also more and more recognised as a helpful method in the conservation of nature and **natural resource management** (NRM). Environmental and ecological monitoring was introduced into development projects in the 1980'ies, initially with a focus on large infrastructure projects. In recent years, also along with the need to extend accountability and strengthen planning and impact analysis in international cooperation, ecological monitoring is attracting increasing attention in all forms of development projects and initiatives. It was proven in several surveys that ecological monitoring has positively contributed to programmes in conservation and development. Whereas monitoring as such can be carried out everywhere, meaningful ecological monitoring is only feasible in **projects,**

- which can possibly – directly or indirectly - **influence ecological features**, or
- where project success directly **depends on the performance of ecological features**.

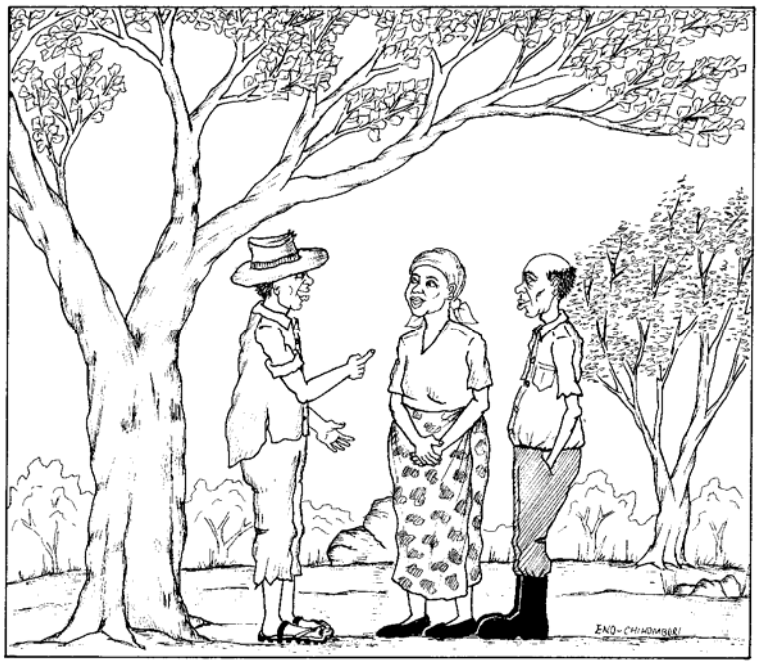
In line with this, ecological monitoring has become an important component of projects and initiatives relating to agriculture, forestry and fishery and measures that focus on nature conservation, management of natural resources and rural development. However, ecological monitoring can also be carried out outside a specific development project by communities and stakeholders who care about their environment. The ecological monitoring system which we present here focuses on the use of forest resources but can also be easily adapted to other contexts.

Ecological monitoring is very **flexible** and can be designed according to the specific needs of the context. It can focus on single factors, such as soil quality, plants or animals, or it can look at the environment as a complex system.

3. Why ecological monitoring ?

As mentioned above, **people impact** on the state of the environment with almost every activity which they carry out, for instance when they farm or harvest forest products in the rural areas. Very often, the more intensively people use their natural resources, the more intense the impacts are to be expected. However, the impact of a certain action on the environment, such as the harvesting of fruits from wild trees, is very hard to predict. Natural systems are very complex and it is difficult to know what impacts on what, and to predict non-foreseeable events such as changes of climatic conditions. There is also still a wide lack of knowledge on many aspects of natural resources use.

With ecological monitoring people can recognise whether their action impacts negatively on the resource and/or the ecosystem without predicting the future possibly unrealistically. As **important ecosystem features** are observed with objective methods and **tangible benchmarks** are set, ecological monitoring makes sure that the people do not look at their environment in a too subjective way. The people in the communities or the project implementers can recognize negative effects of their activities or critical trends early and can design correction measures.



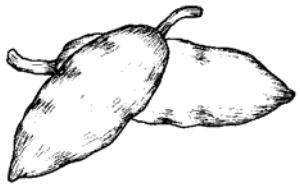
In the **development context**, a project or initiative can only be successful if it does not destroy the physical base and ecological stability of a certain area, even if it does not point at the use of natural resource as such. For instance, if forest resources, such as bark from trees for medicinal purposes, are used in the commercialisation process destructively by ring barking, the tree population will decline or the tree might become extinct in an area. Then the project will need to be stopped without any tangible positive results for the target group and efforts will have been useless. Furthermore, financing institutions and donors also want to know that their funds were spent purposefully which organisations can prove by ecological monitoring.

Keeping this in mind, ecological monitoring can be introduced into development projects for the **following reasons**:

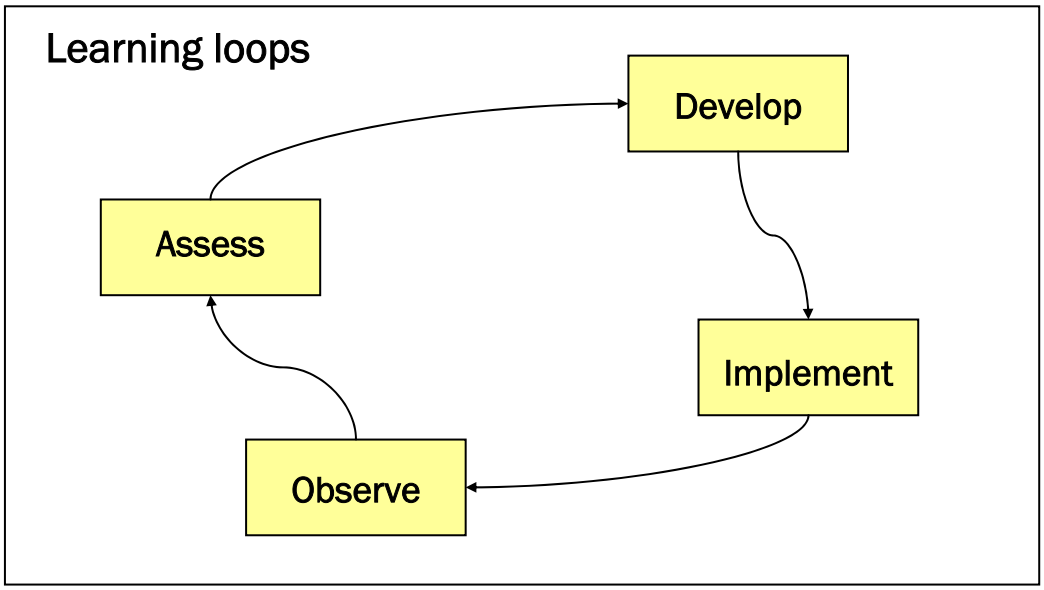
- to gain a clear understanding of the impacts of the resource use on ecosystems and populations of specific plants,
- to support long-term maintenance and growth of productivity and yield of plant resources and maintenance of biodiversity,
- to be able to plan and implement projects in order to enhance productivity and ecosystem health, also by introducing specific resource or ecosystem management measures,
- to detect negative side effects of resource uses at an early point and to plan for corrective action.

4.What is the basic idea behind ecological monitoring ?

Any ecological monitoring process enables an actor or an institution to enter a learning process by providing a base to **adapt action**. In this context an institution can be any social system, as a community group, a community-based enterprise, a development organisation, a rural government body, a rural or urban community or even an individual. These institutions do something, e. g. they engage in commercial Baobab fruit harvesting or in implementing erosion control measures. As the figure below shows, the impacts of this action is observed and assessed by monitoring. If necessary it can be changed as a result of the assessment. It is not being changed if there is no need to do so. Then it would be implemented and then observed again. This way, a harvesting scheme or an erosion control measure can be developed, which is adapted to the needs of the environment and the community. This way, ecological monitoring is basically a form of learning by trial and error.



In order to make efficient use of this opportunity to **learn**, results from the ecological monitoring need to be integrated into the “way of doing things”, such as the harvesting regime or the management of projects by development agencies. As one of the main ideas of ecological monitoring is to be **precautions**, organisations and resource users are given the opportunity to avoid mismanagement by warning them in time. Practically, this means that measures are taken beforehand to prevent future harm, e.g. maintaining collection amounts at a lower level than potentially sustainable even when complete assessment and monitoring information are still pending. It is important that institutions engaging in ecological monitoring are open to change their way of doing things and willing to adapt their actions.



In order to serve these needs, most monitoring approaches, each ecological monitoring has several **basic elements** in common with other forms of monitoring which are as follows:

Defined objectives	Determine which aspects of change are assessed
Indicators	Characteristics that provide concise answers to the monitoring questions (e. g. Marula fruits harvested per tree as indicator of productivity)
Methods	Means of measuring and observing the chosen indicators, but also to register, analyse, and disseminate the findings
A determined frequency of measurements	Frequencies often enough to identify meaningful trends and infrequent enough to avoid excessive work burden
Ongoing critical reflection, on the monitoring methodology	Ensures appropriateness of objectives, indicators, methods and frequency of measurement
Analysis of the monitoring data	Enables the implementers to explore trends and decide next steps
Feedback	Relates to the information gained from monitoring into project planning, project evaluation and/or policy decisions

As ecological monitoring refers to **environmental trends,** indicators, methods and steps of analysis are related to ecology and environment. Usually, ecological monitoring focuses at a number of living and non-living parameters, searches for relations and tries to determine possible impacts. It can, for instance, include inventories, physical assessments, laboratory trials or oral interviews. Data can also be obtained from aerial photographs, satellite images, maps, graphics, statistics, or field work. Furthermore, remote sensing tools can be included, though in many cases they are not necessary. Ecological monitoring records ecosystem trends over a certain time. These can be in an undisturbed natural environment or in an environment which is under a certain pressure or influence, for instance, if forest resources are being increasingly harvested.

An important though difficult issues in ecological monitoring is the base of judgements. When can we regard a natural resource management action as **environmentally sound** or ecologically sustainable? There are many debates and discussions on this point and numerous definitions were brought forward. We are aware that each project has a specific setting and needs specific criteria. However, as a general rule, we propose that NRM can be regarded ecologically sustainable if it:

- does not destroy characteristic landscape features, such as riverbeds or mountain patterns,
- does not harm the delivery of natural services, such as photosynthesis, decomposition, water and nutrient cycles,
- does not actively or passively contribute to the extinction of individual species and
- does not alter the overall composition of species.

When forest resources are used, ecological monitoring should also ensure that the population of the harvested species does not decline below a critical limit.

5. Why participatory ecological monitoring and how ?

This manual describes one of many ways of running an ecological monitoring, namely participatory or **community-based ecological monitoring.** The method which we describe focuses on action and responsibility by the communities. There are a number of **reasons** why we have chosen this approach and think it is most feasible for small-scale projects in rural areas in developing countries.

1. **Communities know best.** Communities know very well about their environment. They have their own indigenous knowledge systems, they have seen what happens they know what factors impact on what and know about critical points that keep their environment stable and healthy. This is the ultimate base for understanding the environment and acting accordingly.
2. **Communities are on site.** Communities usually pass their lies in the area which is meant to be monitored. Instead of time and money consuming travelling of scientists and experts, communities can keep records of ecological trends with comparatively little extra costs. Accordingly, the environmental monitoring can be implemented in much more places, where it can be designed according to the needs and objectives of the specific communities. This will also increase the commitment of community members to spend time for implementing the ecological monitoring.
3. **Communities need the information.** Ecological monitoring is carried out for the well-being of the communities and their environment. If communities would not need and want the monitoring, there would be no need for implementing it. If communities take part in designing the ecological monitoring, there will hardly be any unneeded information collected. The observations will be closely liked to the way people use resources. The monitoring can best work as a decision-making instrument on the community-level if it is directly linked to community action.

This does not mean that there is no **need for experts** when carrying out community-based ecological monitoring. Experts can provide support at various stages of the ecological monitoring process. In our system, it is recommended that they become part of the process during the set-up of the process and the adaptation of the harvesting patterns (see chapter 8).

In order to be a feasible community-based instrument and to give guidance to resource users and project implementers, we wanted our approach of ecological monitoring to fulfil the following crucial **requirements:**

- It has to be able to deal with very heterogeneous NRM-related projects and needs to be adaptable to specific project needs.
- Field staff should not need excessive working time for the set-up.
- It can also be initiated and supported by project officers who are not necessarily ecologists.
- Traditional knowledge has to be a central part.
- Customs and traditions concerning the use of natural resources have to be respected and traditional and customary rights need to be safeguarded.
- It should involve as little additional costs as possible. Ideally it should be cost-neutral.
- It has to be self-sustaining, i. e. it would not need to have permanent input from field staff but could be maintained by communities and district-level stakeholders.
- It had to be able to deal with lack of information on natural resources, distribution, genetic diversity and sustainable yields, but also on impacts of the land use systems, as in many project regions there has been little research and documentation in the past.

As each ecological monitoring process will need to be different, the implementing officers have to decide in each single case how to use the recommendations given in this manual in order to best serve the goals of their projects. There are no strict laws, neither a fixed procedure for ecological monitoring. There are two ways of adapting the steps which are described here to specific needs.

1. **Monitoring the monitoring.** The steps can be run as proposed here and it can be observed how it works, what work and does not. Then the officers can stepwise develop an own adapted system for use in similar processes.
2. **Using it as a source of inspiration.** The steps as they are proposed here can be changed right from the start, for instance by leaving out steps or introducing new ones or just carry out single elements.

6. Why ecological monitoring for the use of forest resources ?

This chapter explains why there is a **need** for ecological monitoring when people extract forest resources. This is our background for developing this system and might be of particular interest to staff of organisations which work in a similar field as we do. For the others it may give an introduction into one setting of expediently using ecological monitoring.

For a long time, it was taken for granted that the small-scale usage of forest resources (or non-timber forest products), such as fruit, bark or leaves from tree, has **little impact** to the forests or no impact at all. The small-scale commercialisation of forest resources was seen as a very good way of increasing income of households, improving the nutritional base and even of conserving woodlands. A closer look on long-term effects of NTFP usages showed that this assumption was not correct. In some cases a decline in the stability of the ecosystem or its ability to process nutrients or to regenerate after events such as fire was detected. Some usages of forest products such as the pepperbark-tree *(Warburgia salutaris)* in Southern Africa almost led to the **extinction** of the species targeted. Also science has shown that each commercial extraction of a forest resource will lead to measurable ecological effects and can affect ecological processes on many levels, from the individual and population level to the community and ecosystem level. Of course, these can be very different according to the amounts and plant parts harvested, the techniques used and the management procedures in place.

Usually, each forest product in any given habitat has a specific maximum level **of sustainable harvest** though it might not always be known to the resource users and is often difficult to be calculated. This is the level (or amount) of harvesting at which the harvesting will most likely not lead

to negative ecological results. Very often, it is equivalent to the annual production. If this level of harvesting is not respected, the plant populations will deteriorate in quality and/or quantity, the ecosystems, including animals that depend on the plants, will eventually change and their resilience will most likely decrease. Resilience describes the strengths of ecosystem to tolerate adverse conditions, e. g. extreme climate conditions or fire. For instance, even by the collection of rather limited amounts of fruits from the Baobab tree, the re-growth of the tree is affected and the structure of the woodland will change over time by decreasing numbers of one of its key species.

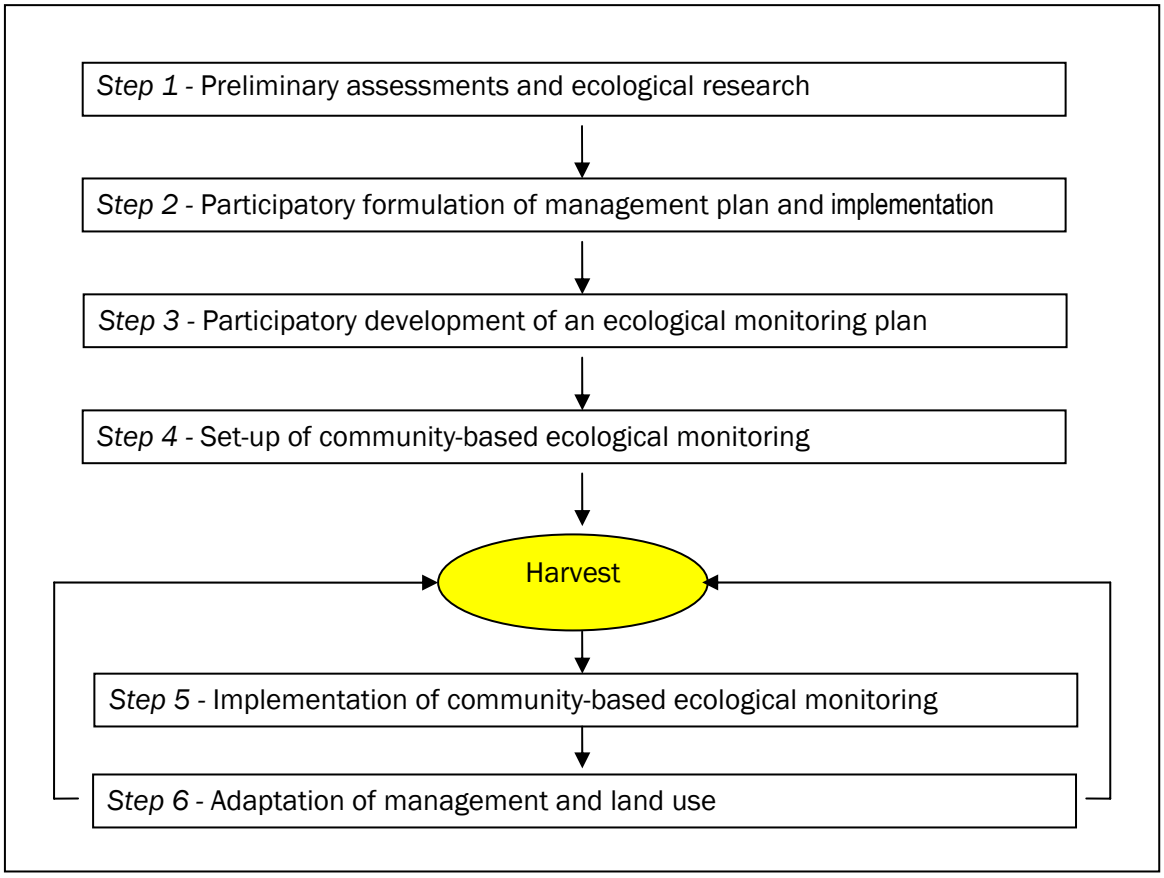
As we have explained above, it is **hard to predict** how single plants, populations or ecosystems react to changes. They are very complex, often react surprisingly and we do not have sufficient knowledge on the impact of using forest resources. Growing demand in forest products will in many cases in the future intensify the harvesting and push it beyond the level of sustainable harvesting. In order not to destroy the population and the ecosystem, we had to develop this approach of ecological monitoring. Ecological monitoring provides valuable information on the status of harvested forest resources and helps the collectors to detect first signs of destructive use and to realise that the level of sustainable harvesting has been exceeded.

Natural Resource Management is a social process. In an environment with **challenging economic and social conditions**, it has more obstacles to face. For instance, insecure tenure rights, the competition of modern and traditional laws and practices and the lack of effective NRM institutions make an adequate regulation of the harvested quantity more difficult. In some countries, resources are also at risk as customary laws that have been regulating the access and use of resources became weaker, without being adequately replaced by modern laws. As these phenomena increase the risk of over-harvesting, ecological monitoring can also be a means to respond to these challenges.

7. Which steps to take ?

Our way of implementing ecological monitoring consists of 6 steps as illustrated in the figure below.

- **Step 1:** Preliminary ecological research action forms the base of any action in a project area. The research will mainly consist of assessing ecological aspects in project feasibility studies and resource assessments.
- **Step 2:** Management plans for the resource use are developed in a participatory way on the base of the ecological assessments and their implemented is started.
- **Step 3:** The plan for the community-based ecological monitoring can be developed by communities and field staff.
- **Step 4:** The community-based ecological monitoring is practically set-up on the base of this plan.
- **Step 5:** The ecological monitoring is being implemented.
- **Step 6:** The ecological monitoring process forms the base for the adaptation of the management procedure, the ultimate goal of the monitoring process.



Each of the instruments is **based on the previous instrument.** It incorporates its content and results, where applicable verifies its findings and leads to concrete action. At the core of the ecological monitoring are Steps 3 to 6. Step 1 and 2 constitute the preliminary activities whose exact nature will depend on the intervention or the projects or initiatives. They can be reduced or completely left out, especially if the community-based monitoring is not directly associated to a development project or similar activities were already carried out.

In the following descriptions to the steps, each of them is explained in **4 subchapters:**

- What are context and objectives ?
- How is it done ?
- What are the results ?
- What needs special attention ?

A focus on the extraction of forest resources will be noticeable in the descriptions as this was our background of developing this method. However, it will be possible to adapt the methodology to other fields in NRM as described in chapter 5.

Step 1 - Preliminary assessments and ecological research

What are context and objectives ?

When starting a development project or initiative, the feasibility and the nature of the intended measures have to be examined and specified. This is usually done in ***feasibility studies***, which in natural-resource based projects usually also have a NRM component. Once the feasibility studies have been successful, the implementation of ***resource assessments*** is recommendable whenever specific resources are used. They assess the standing stock and production of the resource which is intended to be used. These data are to be used later for expedient project design.

The objectives of preliminary research and resource assessments are:

- to identify current NRM challenges, NRM-related developments of the recent past and potential threats that might appear in or after project implementation, caused by the resource use or other factors,
- to assess the status and vulnerability of the resource, determine harvestable material and sustainable harvesting levels,
- to give clear recommendations for the implementation of the project/initiative,

- to provide the basis for the management plan and the development of the monitoring plan, and
- to identify current harvesting/ resource use techniques and management strategies.

Feasibility Study

Usually before deciding to enter a new project area, organisations involved in development usually run **feasibility studies**. These are meant to generally assess the possibility of sustainable usage and harvest., to gain a physical appreciation of the resource use area and its main ecological parameters, to estimate whether and which species of the area can be harvested for commercialisation and to identify core environmental issues to be addressed. The methodology for feasibility studies can include similar steps as resource assessments but need not to go to far into detail. It can also entail group discussions and key-informant interviews. Additionally, literature from previous ecological research should be reviewed if available.

The **physical appreciation** should be a rough general appreciation of the area. The features listed in the table below should be physically assessed and documented. Furthermore we have made good experiences with sketches dividing the area in zones of different use and vegetation zones. The size and extent of the resource availability should be roughly estimated to allow for a calculation of production levels.- woodland types and species

- *Woodland types/species*
- *Diameter classes*
- *Height structure*
- *Signs of removing/harvesting*
- *Signs of defoliation and other negative influence on trees*
- *Signs of coppicing, pollarding or pruning*
- *Ripe fruits*
- *Seedlings on the ground & others signs of reproduction*
- *State of grass layer, bush layer, signs of land degradation*
- *Soil - extent of erosion*
- *Water, hydrological features*
- *Climatic conditions*

It is recommendable that **key informant interviews** are led with users of the resources, traditional leaders and local entrepreneurs. They should follow a pre-determined semi-structured questionnaire in one-to-one or group-interviews and deal with land use changes in recent years and nature and extent of signs of landscape change, changes in vegetation and production of biomass, land use and property conflicts, history of land-use and management and general environment-related observations over the recent past.

In order to be able to take a decision on whether or not to intervene in an area and which resource to target, it is recommended that the main findings, basic facts on sustainable harvesting amounts and potential risks for harming the ecosystem are included in a report. The report can then be discussed with the communities and relevant stakeholders in the intervention area in order to come up with a decision on the intervention. It is also helpful if it lists the most important environmental issues to consider and determine issues to be addressed in the resource assessment more detail.

How is it done ?

The resource assessment should be carried out once the feasibility study has led to a positive result concerning the feasibility of the resource use. It will need to entail an in-depth physical assessment, literature review and structured key-informant interviews.

Physical assessment

The physical assessment will assess the composition and condition of the woodland and analyse the standing stock if a specific resource is targeted. The **general condition of the ecosystem** draws on the analyses of the feasibility study and produces more reliable and detailed facts on the environmental issues which were mentioned and are relevant for the expedient extraction. We propose that apart from those mentioned in the box on feasibility studies it also takes the following aspects into account:

- Radiation, temperature, rainfall, evaporation
- Ways of land use, signs of land use, erosion, paths and ways, exposition to winds, shape, ways of management, signs of overgrazing,
- Fires: intensity of fires, frequency or incidence, risk or prevalence
- Soil quality and structure: leaching, desiccation, water logging, acidity, compaction, rill erosion, sheet erosion, gully erosion, denudation and deposition
- If applicable: water quality, pollution and flow - sedimentation, salination, euthrophication, nutrient discharge, changes in water flow, drainage limitation, run off, water logging, flooding rate, water bodies

The **inventory** seeks to get an overview on the structure and composition of the vegetation in the respective area. Usually, it is recommendable to use transects over a wide range of vegetation zones. Vegetation, vegetation zones and forest types should be determined, including measurement of age classes and diameter ratio of key species. Special focus should be on collecting information on threatened as well as invasive species. It is proposed that for trees abundance, condition, height, fruiting, special observations, species, sings of harvesting, signs of diseases, seedling distribution patterns and occurrence of regeneration are assessed. At trees, observations will be based on age classes and diameter at breast height (DBH). For the inventory, enumeration forms need to be developed and followed. A sample data collection form is to be found in Annex 1 of this document.

Methodological Experiences from our work

For the physical aspect of the **resource assessments**, we usually lay different numbers of transects (2-5) in varying distances (100 m – 2 km), mostly randomly. They comprise a varying number of plots which often aim to cover the highest variation of land use patterns and environmental factors. Sometimes, tangential transects are also used. Along the transects, plots of a size of 100 m^2 are targeted in fixed distances of 250 or 500 m. In the plots, all trees of more than two meters height are recorded with diameter at breast height. Evidence of woodland disturbances and other visual observations are noted. According to the resource which is targeted, leaf status is also assessed in some studies in terms of size and signs of harvesting. Whenever possible, the transects are done together with members of the communities in a "Participatory Resource Assessment". Usually we take GPS (Global Positioning System) data from the plots so that we can re-locate them.

Interviews should be held with key informants, such as village elders, members of ward NRM committees, representatives from Agricultural Extension Services (AREX) or Forestry Commission or other knowledgeable and experienced people. They can give important information for the set-up of the ecological monitoring. Even if only a limited number of interviews can be carried out, they can provide a valuable source of information. An exact guideline should be drawn up before the start of the interviews and the interviews should be documented by notes. We propose a focus on the aspects listed in the table below.

- Ecological problems/ challenges
- Landscape changes in the recent years
- Management practices in place
- Participation in management practices
- NRM Institutions in place
- Any ecological research/work done
- Quantity harvested of targeted resource
- Development of harvested amounts in recent years
- Harvesting techniques
- Collectors
- When is collected and why at this time
- Changes in harvesting areas
- Other sorts of land use/tree cutting

In this context, also different **PRA approaches** can be used, such as transect walks, semi-structured interviews, seasonal calendars, daily activity profiles or timelines. In participatory mapping and modelling people use the ground, floor or paper to make social, demographic, health, NRM (soils,

trees and forests, water resources etc.), farm or village maps. Many development organisations know these methods well and can decide according to their experiences and core areas on the exact approach.

Literature survey. Not all information has to be collected in the field. Often, there is already a lot of information available in project documents or on the internet. A literature survey can bring up information that could not be collected in the field. For the further design of ecological measures, it is very helpful if biological characteristics (as habitat characteristics, distribution pattern, and vegetation association) of plants which are used are known in order to adapt the management plans accordingly. Often physical characteristics of the project areas (climate, topography, souls, geology, watersheds), can be analysed before the actual field trip. Desk work can also include delineation of the study area, the preparation of a base map or the acquisition and interpretation of aerial photos.

What are the results ?

Results of the resource assessment should be compiled in a **report**. In the context of the use of forest resources, main results will include the (1) recommendations on ecosystem management and (2) recommendations on NTFP extraction.

Recommendations on ecosystem management - These should refer to reducing ecological risks and mitigating potential threats to the ecosystem. Some points to be considered are mentioned in the table below. They do not need to be all covered; however, they will be helpful when carrying out the steps thereafter.

Biodiversity and genetic resources	How significant is the contribution of the area to protection of biodiversity and genetic resources in the region? Also is it a wildlife breeding area or corridor?
Water	How significant is the contribution of the area to water quality and flow in the region?
Air	How significant is the contribution of the area to air quality in the region?
Fire management	How significant is the contribution of the area to fire management in the region?
Flood control and watershed protection	How significant is the contribution of the area to flood control and watershed protection in the region?
Soil quality and protection from erosion	How significant is the contribution of the area to soil quality and protection from erosion in the region?
Carbon sequestration	How significant is the contribution of the area to the sequestration of carbon?
Climate stabilisation	How significant is the contribution of the area to climatic stabilisation, particularly drought mitigation?
Climatic factors	How has management of the area been affected by either floods or drought or both?
Pest and diseases	How has management of the area been affected by pests and diseases? Have there been instances of disease affecting livestock and wildlife?

Recommendations on NTFP extraction - If the development initiative will include the usage of forest products, you will need to predict, how the resource will develop under use. From this, conclusions can be drawn on whether and which measures can support a healthy population and which mitigatory measures might be necessary. It is also important to judge whether current rates of harvest already constitute threats to the species and in which secondary effects for the ecosystem harvesting can result. It would be ideal to determine sustainable harvesting levels for all harvested species. Unfortunately this is extremely difficult to do. However, attempts should be made and current practice for calculation of sustainable harvesting levels reviewed and incorporated. In this case, estimation will already be helpful.

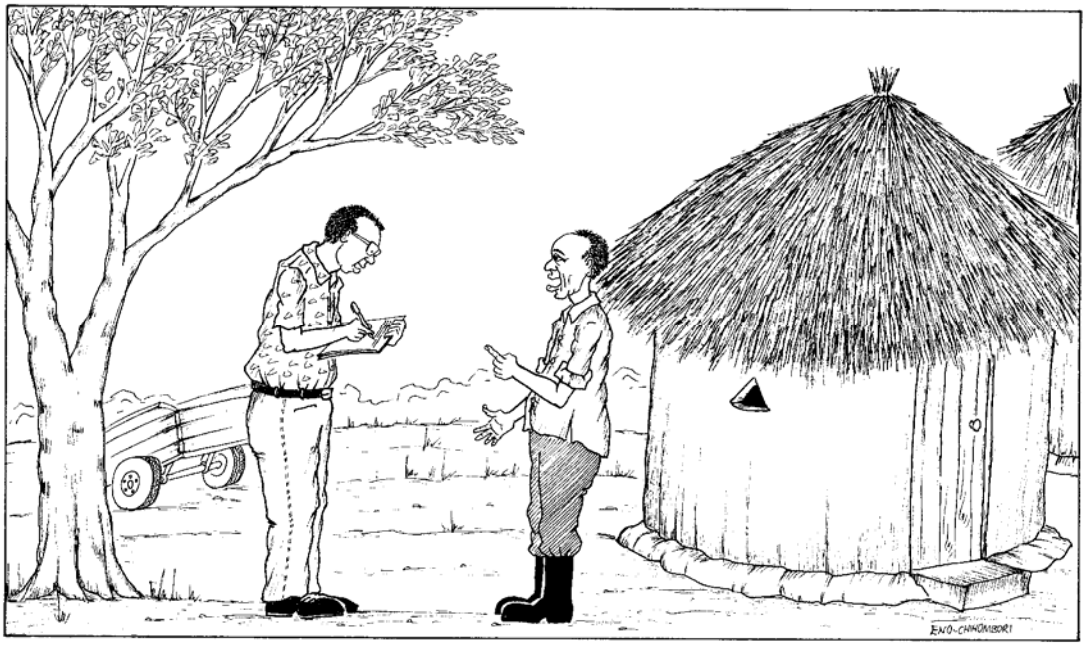
Wherever possible, the resource assessment report should already specify the **recommendations** to specific groups of the communities, officers or stakeholders. Work will be easier later, if **tentative indicators** for ecological monitoring can already be identified and included in the report on the resource assessment.

In the further steps of the ecological monitoring process, a **back-up-person** should be responsible for supporting the local structures in the ecological monitoring by regular check-up and assistance with challenges such as the development of adaptive measures. In the course of the preliminary assessments, the field officers should already try to identify persons which could possibly take over this role. Ideally, they should represent an institution, which will be functional or working for a long-term perspective, has the necessary knowledge of NRM, knows the project and has good personal relations to the community. However, also a motivated knowledgeable key person from the community could be identified (see also Step 4).

What needs special attention ?

- In many countries the **"Community Entry"** is of outmost importance. A number of formal steps have to be taken, before the work in the actual communities can begin. The locally relevant procedures for the Community Entry should be followed carefully in order to allow for the base for project success.
- As in all other steps, the **composition of the team** has to be carefully determined before the onset. The teams should at least include two officers with experience in community participation, PRA techniques and expertise in different areas of NRM. One of them should be familiar with the methodology and should, if possible, have received a start-up training on this issues. If possible, one of the officers should be acquainted to the community.
- The advantages and disadvantages of the **different seasons** for the assessments should be taken into account. Usually, the advanced growing period would be most favourable for both the feasibility study and the resource assessments as unambiguous identification of plants is possible. However, for the feasibility study, dates can be handled with more flexibility.

- It proved to be helpful to have the **data collection sheets** and interview guidelines in place well before the onset of the trip in order to provide the officers with the possibility to familiarise and to agree on necessary changes. Also, camera, tape measure, reference literature and are necessary to take along.
- Step 1 includes some very important groundwork for the entire process and enough time has to be committed. It is usually the most **time-consuming** step in the set-up of the ecological monitoring. The implementation of the feasibility study usually comprises one week, the implementation of resource assessment two weeks in the field. One week should be reserved for compiling the report.



Step 2 – Participatory formulation of management plan and implementation

What are context and objectives ?

It is recommendable that each commercial extraction of natural resources beyond the household level and all significant changes in land use patterns in communities should include the elaboration of a management plan. Management plan can greatly vary in terms of content and degree of formalisation. Basically, the communities are supported to **develop and plan NRM-related activities**. The management plan usually includes information that is meant to clarify which resources will be used to which extent and which accompanying measures are being implemented by whom. If there

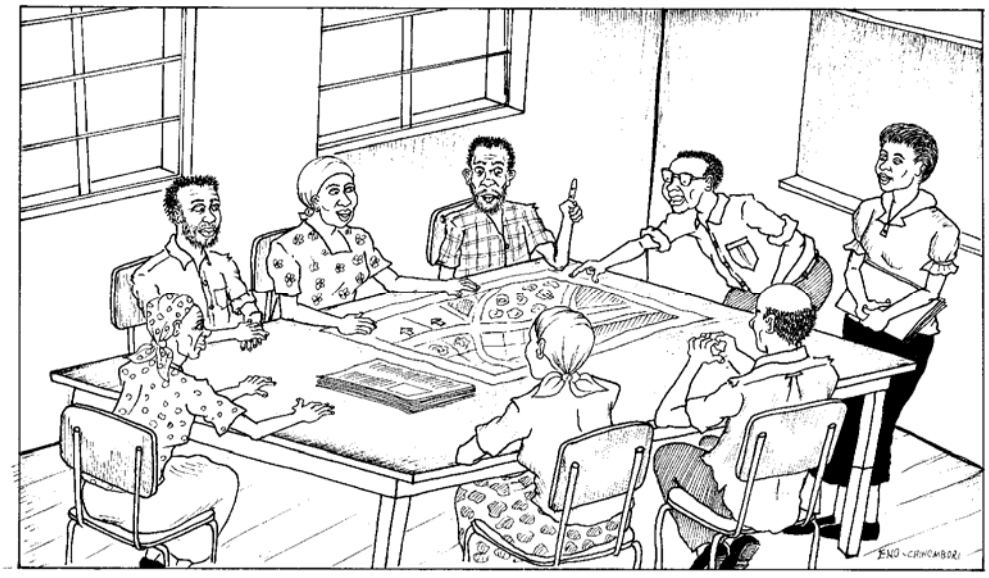
is no plan, the risk is high that everybody keeps on doing what he/she want to do and any efforts to regulate resource use will remain useless

Management plans are meant to provide a **base for the adaptive management** of natural resources, to identify main resources and livelihoods activities in a given area, to compile resource use problems and to determine possible fields of action in order to ensure sustainable use of natural resources on a long-term basis.

Actually, ecological monitoring can also be implemented without a management plan as the two instruments are in principle independent from each other. However, in order to be consistent, formalised monitoring should be implemented after the **formalisation of land use** as such. A management plan serves as a common agreement which supports the sustainable use of natural resources and minimizes potential threats that were previously identified in the resource assessments. According to their scope and content, the accompanying measures can be either carried out by the implementing development organisation, the community or other stakeholders.

How is it done ?

If possible, the preliminary study (as explained in Step 1) should provide the base for the participatory development of a management plan. The management should focus on the **intended land use or resource utilisation changes,** and, in order to be accepted by other stakeholders, it needs to be developed in compliance with national and local action plans (such as District Environmental Protection Plans), as far as these exist. It is recommended that the resource assessment report is finalised before the development of the NRM Plan, so that the results can be used. If this is not possible for logistical reasons, NRM plans can be developed with the communities following directly after Step 1, though results should then be clearly determined and orally summarized.



We propose to develop the NRM plans in a **half-day workshop** by developing the sessions according to the table below. We recommend that for each natural resource which is used by the communities, the category of use (construction, firewood, livestock feed, medicinal etc.) and the physiological part that is harvested are listed together with the community. Furthermore, for each relevant resource, the resource status and trends is recorded and remarks are listed with regard to recent changes in resource use or changes in the resource condition, e. g. increase in soil infertility. Subsequently, NRM-related problems are compiled, objectives for NRM agreed upon and a Community Action Plan developed following the example mentioned above.

Session	Description
1. Presentation, discussion and validation of current situation and action	This includes an introduction on what the team has already done and the findings of the feasibility and the resource assessment. It also includes an explanation of the planned process and the stakeholders involved.
2. Developing NRM strategies	Based on the current status, the desired state is agreed and described. Suggested strategies are collected. Propositions can come from the field staff but preferably should be brought forward by the community. In the discussion, objectives and strategies should be further formulated based on desired state and discussed with crucial inputs from all stakeholders present.
3. Prioritisation of the strategies	As not all strategies can be pursued, the community needs to prioritise in terms of importance and feasibility. It needs to agree on objectives, strategies, location and activities as per strategy selected. As a prerequisite, framework conditions in terms of available financial means and roles in implementation need to be clarified.
4. Produce an action plan	Accordingly, an action plan is produced which included specification on who implements which action using which resources in which time frame.

Alternatively, the programme can be divided into three sub-workshops in order for a more thorough and in-depth development of the management plan. In the workshops the following issues can be discussed:

1. **Workshop 1:** Situational analysis,
2. **Workshop 2:** Report back of situational analysis and development of strategies,
3. **Workshop 3**: Feedback of strategies and development of management objectives and community action plan.

What are the results ?

As was mentioned above, the management plans can be of **varied degrees of standardization and formality**. The format can vary but should be agreed before in the team before the development of the plan in order to avoid methodological confusion. However, it should as far as possible be standardised in an organisation and/or a project and needs to be adapted to the size and

complexity of ownership/tenure if the collection area and the resources used, the scale and intensity of the collecting operation, and the likely impact of the collection activities on the targeted resources and habitat.

We have made good results with developing **community-based management plans** as presented in Annex 2. The plans should be developed in the language which is spoken by the majority of the community members. After the session it should be pout into electronic format by the officers and be handed over at the next visit to the project area with as sufficient number of hard copies.

An example from our work

In the project areas of the SAFIRE Medicinal Plants Project, the NRM strategies previewed in the management plan included collection, compilation and dissemination of sustainable harvesting techniques, which were presented in a brochure and introduced in trainings. No-use zones were demarcated and an access-and benefit sharing scheme is being implemented on the base of an anti-poaching strategy which had been developed earlier. The development of management plans was closely interlinked with the development of business plans for the small-scale medicinal plants enterprises.

What needs special attention ?

- The highest risk is to be **unrealistic** when developing a management plan. Though it is tempting to plan 'ideal action', there is no use for a plan which cannot be implemented. The development of a management plan is very often used as an opportunity to imagine, what could be done given ideal circumstances of funding and commitment. In order to really come up with positive results, we recommend to rather plan with limited commitment and funding and to come up with a plan which can be later extended than to draft unrealistic plans.
- Officers have indicated that for reasons of efficiency and clarity, it is recommendable to initially only **choose one NRM objective for action.** The others should be addressed at a later stage. The timing for this step can also be determined in the management plan.
- This step does not require a **specific season**. It is recommended to be carried out when people have enough time to attend the workshops, i. e. not during the harvesting period or other agricultural peak periods. It should be carried out at a central place which can be reaches by everybody. All people from the community should be aware of the meeting and should be invited. Local authorities and government departments working in the area should also be invited.
- Very often, in the course of the development of a management plan, the implementing organisation promises to **support** to certain NR-related measures financially or technically. If this support is promised, it also has to be provided later. If not, trust of the community to the implementing organisation will diminish and NRM success will be hampered.

- An important (and often difficult) issue are **tenure and decision** rights. They have to be carefully taken into account. Often they determine who has got the authority can decide on resource use in specific areas. In communal land, very often decisions will be drawn in consensus with the communities, however they have to be shared by the stakeholders with decision powers and the elders. These persons have to be given a special position and authority. On private lands, a management plan can only be designed and implemented with the direct participation of the land owners and their consent.

Step 3 – Participatory development of an ecological monitoring plan

What are context and objectives ?

In this step, based on the preliminary work done in Step 1 and 2, the needs for ecological monitoring in the specific project context are assessed and a monitoring plan is being drafted together with the communities. As far as possible, it is based on traditional systems of ecological monitoring and previously introduced record systems and formalises and harmonises them as necessary. Though the results for the preliminary assessments and the management plan can help a lot, the formulation of indicators is one of the main challenges. As with all other steps the most important guideline is to keep it as simple as possible.

By definition, monitoring is a rather formalised procedure, which means that it also has to follow a plan, which sets the **framework for the entire process.** In order to be a proficient guideline to ecological monitoring for all participating community members and other stakeholders, the plan should clarify the following:

- who is going to collect and register which information,
- where it is going to be carried out (which woodland areas, how many in sample size),
- with which method,
- when (how often and which month/week),
- who is going to record and analyse the information, and
- who is going to use the information gained for adaptation of management.

How is it done ?

In our work it has proven to be successful to organise **one-day community meeting** with key stakeholders from the communities and enterprises. They should include all major interview partners from the previous steps and members of the local NRM committee. The table below shows the main sessions of the meeting.

Session	Comments
Introduction, idea and purpose of workshop	• Officers explain the background of visit and relation to previous visits, give information on programme and expected outputs and on basic idea behind community-based ecological monitoring. They also answer questions.
Group discussion: ecological risks and problems, effects of natural resources usage, traditional ways of monitoring the environment, need of ecological monitoring	• This also summarises and incorporates results from previous trips.
Presentation: suggested outline of ecological monitoring, rules and responsibilities	• Officers give a presentation of how a monitoring plan can look like and of the next steps. They give the community members a concrete idea how ecological monitoring is meant to work, ways of participation and tasks associated
Group Discussion: Compilation of tentative indicators	• Firstly, a brainstorming is carried out on critical developments and how they could be captured by indicators, which records exist and what is it that the stakeholders want to monitor or evaluate or anyhow monitor for their livelihood activities • The list of indicators should be compiled. If indicators which are considered important by the team should be missing, they can be brought into the discussion by the officers (e. g. by asking indirectly "Which other significant changes have you observed in your environment over the past ten years ?) but should be subject to reviewing and approval by the community. At the end of this point, the indictors should be ranked and a maximum of ten indicators should be chosen.
Group Discussion: Development of monitoring plan	• Now the respective row in the monitoring plan should be filled for each indictor. First, means of data collection, frequency and responsibilities should be finalised, then the critical values set. • Active facilitation from the officers is necessary at this point. Not each and every point has to be subject to extensive discussions, however central decisions should be discussed. • As the indicators are re-discussed concerning levels at which immediate action would be necessary, field staff from the implementing organisation support with their expert knowledge.
Group discussion: the way forward	• This step includes sharing of tasks, role of NRM committee and responsible agency, assessment of needs for capacity building and clarification of next steps (including time).

What are the results ?

At the end of this step, a **preliminary monitoring plan** should have been drafted which should basically follow the format presented in Annex 3. Some minor changes might be necessary to this monitoring plan thereafter during the implementation though no major alterations should be done without community consultation and consent. An example for an ecological monitoring plan is presented in Annex 4.

When forest resources are used, the ecological monitoring plan will usually consist of **two parts,** mainly (1) the monitoring of critical ecosystem features and (2) the monitoring of critical threatened and/or harvested species. We want to explain on four critical types of information to be included in the monitoring plan more in detail.

The indicators

The development of indicators is a crucial part of the set-up of the ecological monitoring plan. The indicators determine which **changes are being recorded** and what the monitoring focuses on. Accordingly, they need to specifically address the critical NRM challenges which were identified in Steps 1 and 2. The determination of the indicators is likely to be one of the most difficult steps because often many different indicators are being proposed which involve various techniques and different challenges. The choice of indicators will depend on several factors, particularly the availability of data and the ease with which they can be recorded. There should not be too many indicators in order to keep the workload for the ecological monitoring feasible.

Possible indicators can be derived from

Species level

- Changes in resource availability (e. g. measured through walking time to obtain resource),
- Changes in resource supply for livelihoods activities (such as crafts making),
- Growth rates and regeneration,
- Collection volumes with locations and times (where applicable also: records of licenses issued),
- Other uses of targeted species/populations,
- Illegalities detected (poaching) and measures taken in response,
- Vegetation and the condition of tree individuals (bark harvesting occurred etc.).

Ecosystem level

- Change in impact for disturbances such as fire and floods,
- Change in ecosystem composition, species richness and abundance and distribution,
- Change in location and extent of forested land (plantation and natural) and rate of change,
- Location and extent of alien vegetation cover, and rate of change,
- Percentage of forest cleared for arable and, construction material, fuelwood, human settlement etc.,
- Degree, reliability of management and regulation of other activities regarding NRM

Indicator Development

Some of the indicators which were proposed during sessions in one of SAFIRE's projects.

Main NRM challenges	Possible indicators
High rate of uncontrolled fires	Time of occurrence, rate of occurrence, area burned, species of grasses (growing in previously burned areas)
Deforestation for tobacco and brick industry	Number of farmers growing and processing tobacco, area planted with tobacco ,amount of wood needed, number of people making bricks, numbers of ovens in place, quality of wood required. types of trees used
Deforestation	Diameter/height classes (to be assessed in PSPs or biannual resource assessments), number of browsers (decreases with decrease in number of trees), incidents of baboons entering fields (increase with decrease in fruit trees numbers) ,number/percentage of trees debarked
Erosion	Increase in size and number of erosion signs/gullies , number of fields with contours, measures adopted for the prevention of erosion, number of people being aware of erosion as a challenge
Siltation	Number of stream bank gardens / gardens established in stream line , amount of siltation ,number of gold panners, area being panned
Alien trees	Number of invasive species (Acacia, Eucalyptus, Lantana camara) , increase in the population of local Acacia (indicate decrease in ecosystem health)

The methods

The selection of methods to monitor the indictors depends on the available **time, skills and resources** of the community members and other stakeholders in charge of the monitoring. It is advisable to identify methods that can be used to assess several indicators at once. Before designing and finalising the monitoring calendar, it should be clarified, who wants and should be involved and which contribution they can give by knowledge and time. As the monitoring will be mainly carried out on village or ward level, visual inspection and measurements will be the main means of verification. A **record book** shall be prepared by the implementing organisation after the completion of the ecological monitoring plan. All observations are meant to be recorded into the record book in order to allow for comparison over time and identification of trends. In many cases, permanent sampling plots will be an important tool of ecologic monitoring, as well as key-informant information.

It has to be noted that it is hard to come up with a perfect set of methods at the onset of the project. At the start of the actual implementation of the ecological monitoring, the methods have to be **tested** as well as any tools used for measuring the indicators. This will ensure that they are relevant, practical and are appropriately used by whom they are used.

Permanent sampling plots

Permanent sampling plots (PSPs) usually provide interesting continuous information about the conditions of the ecosystem, single plants and population. In many cases, information on several indicators from the ecological monitoring plan can be based on data from permanent sampling plots. PSPs can provide easy-to use information but have to be carefully planned and maintained. They should be representative of the vegetation types and their development stages to enable extrapolation form the study sites. Alternatively or additionally, harvested and non-harvested sites can be compared. It is proposed that PSP are demarcated as soon as possible after the set-up of the monitoring plan and are sampled for species distribution, diameter and height classes. It is proposed that sampling is carried out every 6 months at the start, later every year in the growing period in order to gain a complete data set on ecosystem development during the project implementation. In order to take data inflow and evaluation procedure bearable, a maximum number of 10 sampling plots of 50*50 m size seems to be feasible. These are to be distributed according to variety in landscape formations and biotic parameters.

Responsible persons

For each of the indicators included in the monitoring plan, one single person or institution should be responsible for taking the data. It does not need have to be the same person for all parameters, though it should also not differ too much across the indicators in order to increase transparency. The community structures, which will be responsible for the monitoring, has to be determined. We recommend a number of four to eight people to be responsible for the monitoring. It has to be equipped with the skills and material necessary to carry out its duties. In our experiences, usually the **NRM Committee** of the ward volunteered for taking over the responsibility for the ecological monitoring. They were very well able to do so and were supported at various stages by community members. The further existence of the monitoring structure should be guaranteed by selecting a

number of people and explaining on the role of replacing a person if he would not be available anymore. Traditional leaders will usually follow up to the composition of the NRM committee and should be asked to do so.

Critical values

As the ecological monitoring within this project will need to be self-sustained, the monitoring framework needs to specify from its very start on critical benchmarks at which the current management practices needs to be changed and action is needed. We have collected very good experience with defining "**early warning signals**" or **critical values** together with the monitoring plan.

Critical values are thresholds with regard to the indicators which show a need of immediate action and can be easily perceived when monitoring the indicators. These thresholds or early warning signals can relate to production levels, ecosystem quality or harm to individuals such as percentage x of trees being ring-harvested. For instance, the clearance of more than 15 ha of woodland per year for the establishment of house or decreasing of the population numbers of the harvested species under a certain limit could be set as critical values.

It might not be possible to develop a 'perfect and complete' ecological monitoring plan in one session and it is not even necessary. Depending on the communities, the ecosystem and the features of the process, for a start, it might be enough to develop in a rough form and to prioritise them. **After the workshops**, the officers should cross check the indicators and the completeness of the monitoring plan and possibly complete and refine them at the aspects which are still missing. After editing, it again has to be presented to key community members or enterprise representatives and validated though no meeting of the entire community is necessary. Then, hardcopies of the plan should be given to the community and the people in charge of the monitoring in order to be able to overlook the process.

The **report** on the development of the ecological monitoring plan should be compiled as quickly as possible after the workshop and the development of the plan. It should contain a register of main points of discussion and the results and tables developed as well as recommendation to be followed up and internal observations. For organisational and individual learning, the team should also include remarks and recommendations on the process.

What needs special attention ?

- One very important point at the start: **No ecological monitoring can be carried out against the community.** Only if the communities are aware of the benefits of ecological monitoring and if the ecological monitoring plan is designed according to their expectations and needs, it will be actually implemented. Accordingly, special care has to be taken to include the communities in all parts of this process, to raise awareness and to take their concerns

serious. The officer should underline the importance of ecological monitoring for the long-term availability of land use options and, if applicable, the supply of natural resource-based enterprises.

- In order to produce comparable data, the **monitoring time** should be the same every year. Regular half-yearly monitoring visits are most appropriate. End of December and end of June seem to be the best data collection time for most of the Southern African region as they mark the end of the rain and dry seasons and changes can be best identified. Accordingly, not all data can be taken at all visits as some relate to developments in the dry seasons (such as fires), some to the rainy season (such as erosion).
- It is recommended not to have **too many indictors** and to choose few but good indicators. Too many indicators proved to be hard to be monitored reliably. Additionally, a too high number of indicators makes it hard to draw conclusions, as it is difficult to weight them against each other.
- The team has to be very careful that the responsibilities that are taken over by the community can and will really be carried out by the respective persons in terms of **knowledge, working time and commitment.**
- When setting the early warning signals, sometimes **non-quantified** critical values can also be used (species composition extremely changed, few trees remaining). We have made the experience, that in some cases, especially when large quantities are in question, communities can better deal with these descriptions than with exact quantities, which might be confusing and not even necessary. Using 'soft' quantities does not necessarily lead to a less accurate determination of critical situations. If it is impossible to come up with critical values for some indicators, this is not a problem.
- Introducing aspects of **biomonitoring** by indicator species can be also assessed as an option, though this would be rather suitable to an advanced stage of ecological monitoring. Indicators species are species which react very sensitively to changes in the ecosystem, such as lichen but also some higher plant or animal species. However, often special ecological expertise would be needed to determine the indicator value of a certain species and interpret their reaction. However, we experienced that bioindicators for some important environmental features are known to the community members and are even proposed as indictors.

Step 4 - Set up of community-based ecological monitoring

What are context and objectives ?

After the monitoring plan has been set up, **all preliminary action is finally completed** and the ecological monitoring can be given the **kick-start**. Community members have to be trained accordingly, the first set of data should be taken together with field staff form the implementing organisation and PSPs should be marked and initially assessed. Once this is done, the process is in a position to run by itself and can be independently implemented by the community members. It will reveal, whether indicators work and will include quite some conceptual challenges when putting the monitoring plan into reality.

The aims of this step are rather self-explanatory. An ecological monitoring process needs a **first step**. Sampling areas need to be demarcated and the baseline information taken. As the methodology is still very new, special care has to be taken in order to build confidence in the process and to eliminate doubt and uncertainties. The trainings are meant to ensure that the relevant knowledge for data collection is in place and to increase the motivation.

How is it done ?

Three activities are mainly necessary at this point. Each of these needs to be adapted to the ecological monitoring plan developed and the specific community needs. Usually, communities (1) are given a start-up training of a varying nature and extent, they have (2) to be introduced into the usage of record books and collect the baseline data and sampling areas and (3) PSPs have to be marked.

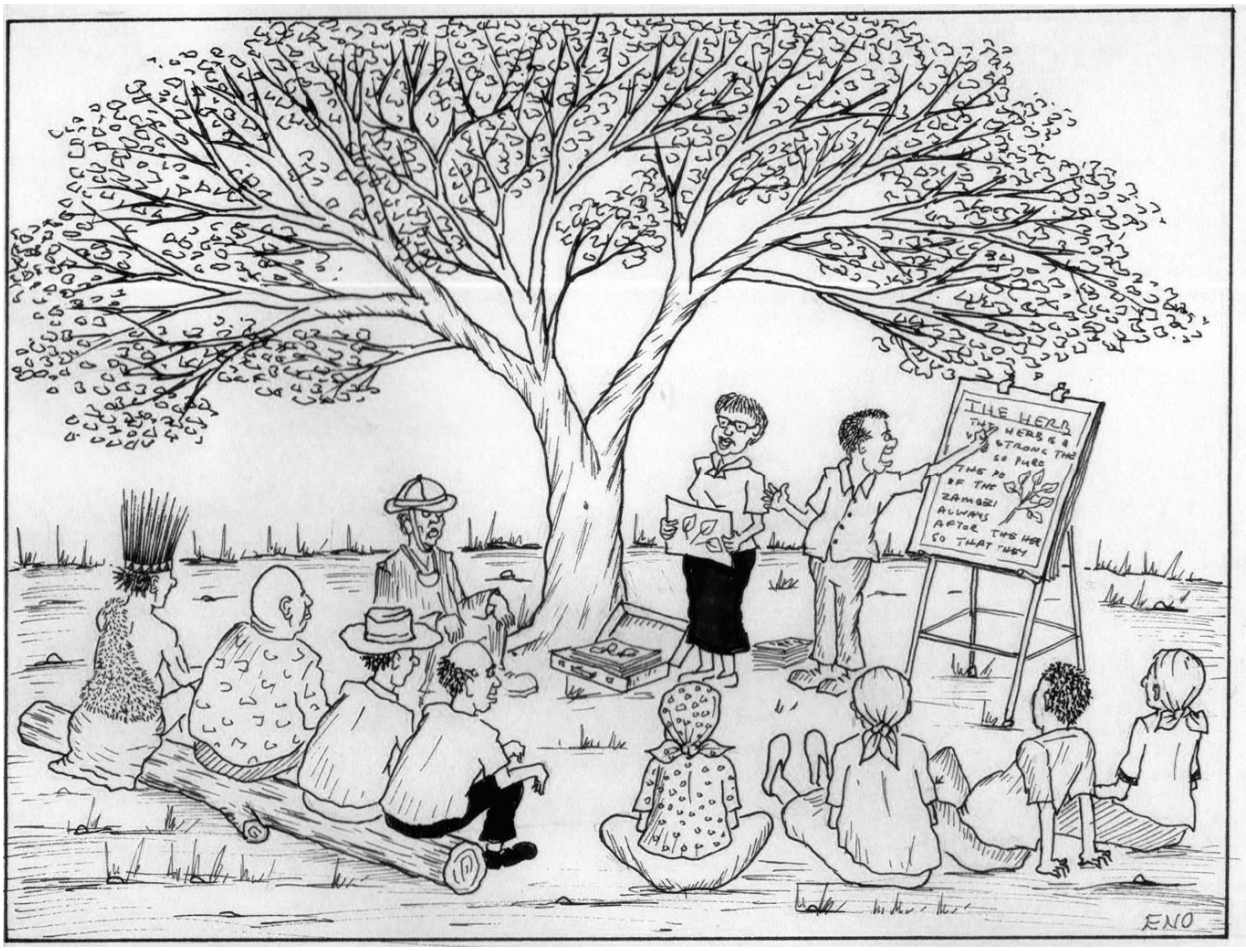
(1) Start-up training

In line with the monitoring plan that had been developed it is recommended to run a **one-day training** for the people which are now responsible for carrying out the ecological monitoring. The training should then introduce into simple methods of collecting ecological data which had been included in the ecological monitoring plan. It should explain on how to take measurements which critical errors to avoid and how to record the data taken. We recommend having a general part explaining NRM and challenges and a more specialised part going through the monitoring plan and discussing the indicators. The training will be backed up the practical collection of the monitoring data in the next step.

It is recommended that the training will be **facilitated** by two officers, one who is well familiar with ecological methods, and one who is known to the communities the regional NRM officer. Apart from the persons responsible for the monitoring, participants can be members of the ward NRM committee, key persons from the community and members of interested governmental structures or NGOs. If possible handouts should be provided in local languages and working material should be

distributed at the start of the workshop. At this point, also the person responsible for the back up of the monitoring should attend and should be given a major role to present itself and get an in-depth understanding of the monitoring.

Depending on the state of institutionalisation of the NRM Committee, it might also be helpful to include a **team-building** session for the NRM Committee at this point.



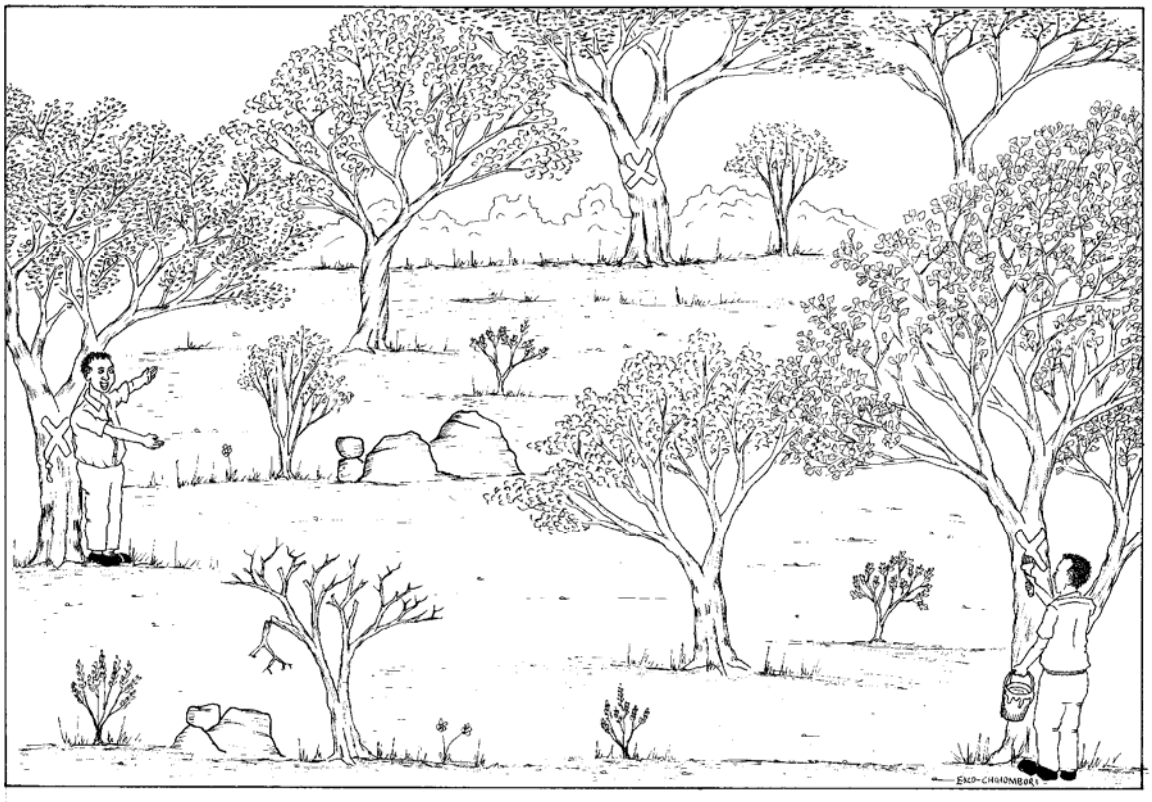
(2) Taking of baseline date and usage of record books

After the completion of Step 3, the officers should compile in the office **record books** for the communities, which will now constitute a major tool of the ecological monitoring process. The ecological record book should be kept by the communities or selected community members. It is meant to compile all relevant data taken for use by decision makers on community or ward-level and should be prepared in local languages. It should be designed by the implementing organisation on the base of the monitoring plan and should be handed over to the NRM Committee, possibly in a small ceremony. Usually, there should be only one record book, though if there are distinct subunits in the harvesting areas, each of them can have a separate record book. The record books should also include the critical values which had been defined in the course of the process. A sample record book in English is provided in Annex 5.

The taking of baseline data mainly consists of **recoding the required data** for the first time in a participatory way. If data on the indicators had already been collected during the baseline surveys, these can be included in the record books and can serve as baseline data. This also helps to assess whether the information on the indicators can be collected at all. Sometimes the formulation of indictors is not clear, or the recording in the field is difficult. If this is the case, the indicators can then be discussed with the community members and be changed straight away. However, care should be taken to include the change in all relevant documents and also in the management plan.

(3) Marking of permanent sampling plots

The PSPs will need to be chosen marked and baseline data will need to be taken. The exact **position** of the PSP and the **sampling pattern** should be determined together with community members according to variability with regards to geographical situation (proximity to human settlements, altitude, exposition), and vegetation pattern. In our work, we usually did the marking and selection of PSPs in the company of community representatives, either the Headmen, a member of the community-based enterprise group or both. PSPs should not include areas with restricted access due to traditions as this might restrict the perspectives for future assessment. If possible, PSPs from previous ecological research in the area can be incorporated and thus long-term data be used.



When setting up a PSP, usually the four coordinates of the plots should be marked with white paint and coordinates of each plot be recorded using GPS. The information should be gathered according to a **data collection sheet** (see Annex 6 for an example). In each plot, transect walks should be made from which both trees and non-woody cover was recorded together with height size estimates and

DBH measurements for trees estimated of over 2 m in height. Alien species and any signs of anthropogenic disturbances (tree cutting, bark stripping and footpaths across woodlands) should be noted. The ecological characterisation of each plot, such as proximity to settlement or river, down- or up-stream position, should also be recorded in the data collection process. For easier analysis and comparison of the herbaceous cover and standardised vegetation analysis, the Braun-Blanquet scale was used for vegetation analysis (categories see Annex 6). If possible, photos can be taken from all PSPs and landscape features and plants of particular interest.

What are the results ?

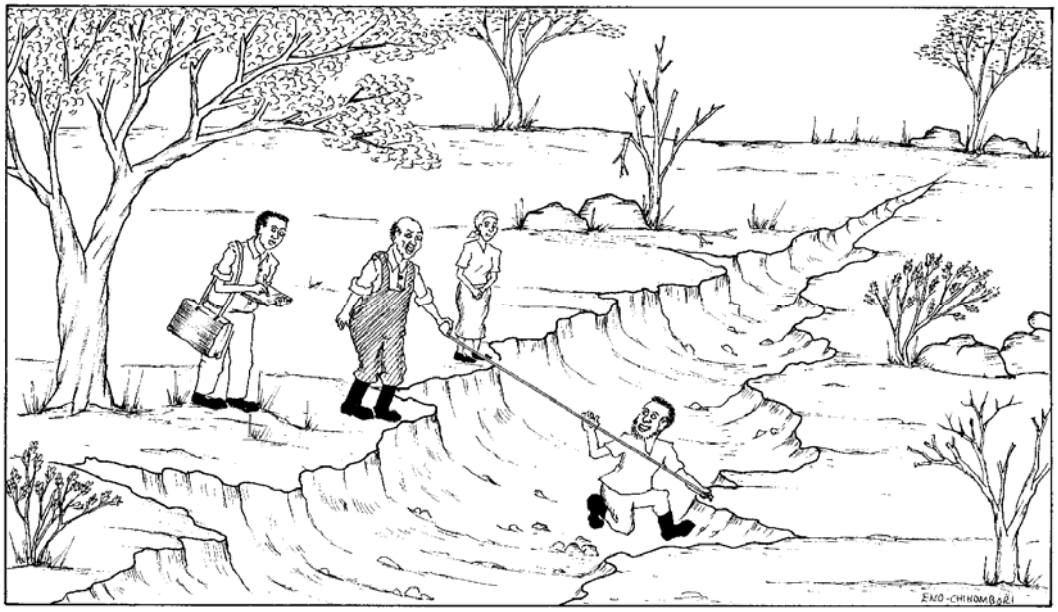
As a result of the training the people responsible for the monitoring have the **means and confidence** at hand to run the process and the confidence to implement the next steps. Additionally **baseline information** is collected in record book and PSPs are marked and have been initially assessed as a base for the further implementation of the monitoring process. Furthermore, the back-up persons (see Step 5) should be aware of their responsibilities, he should have a clear understanding of the process and the motivation to carry out his tasks. The **outcomes and lessons learnt** form this process should be documented by the officers for future implementations.

What needs special attention ?

- A number of practicioners have been claiming that many environmental monitoring programmes **start too early and too soon.** A lot of time is needed on carrying out Step 1 to 4, negotiating the content and building the skills. However, these steps are indeed necessary. The introduction and implementation of ecological monitoring needs to be seen as long-term process and field staff should not pressure communities during the st-up process.
- It proved to be hard to design **suitable indicators** in the office or during the first session. The tentative indicators had to be adjusted in several loops, most importantly when collecting the first data. Only after the set-up has been completed, the indicators can be finalised.
- Data collection at **PSPs** does not need to be too detailed. If time and financial resources are restricted, PSPs can be smaller (25*25 m) and inventory data can be less elaborated without significantly diminishing the quality of results.
- With regard to **key informant interviews**, we experienced that sometimes information was given by respondents on specific aspects of the issue in question but the information did not answer to the indicator as such or information was not as quantitative as needed. When implementing the monitoring, the persons in charge of the monitoring should try to be strict about obtaining the information which is necessary for the monitoring. Concerning some of the indicators, only rough estimates could be obtained first, but with some guidance from officers and NRM Committee members, more specific data could be generated. However, no

pressure should be put on community members to provide information which they do not have or do not want to pass on.

- It is of outmost importance, that the **collection and monitoring area** which is the focus of the discussion and the measurements is unambiguously known to the implanting organisation, the NRM committee and all community members involved in the monitoring. Very often features from other areas than the harvesting areas are also included and data become incorrect.



Step 5 - Implementation of community-based ecological monitoring

What are context and objectives ?

Now that all preparation and set up has been done, the **actual ecological monitoring** can be implemented according to the plan. The ongoing monitoring process tracks environmental trends which can be either caused by a development initiative or another change agent or be independent from this. The results from the monitoring form the base for adaptive action and can also be used to develop further measures for adaptive natural resource management by the communities. This is the core of the monitoring process, towards which all the other steps are pointing. Accordingly, the **aims and objectives stated for ecological monitoring** on chapter 5 most specifically mean this step.

How is it done ?

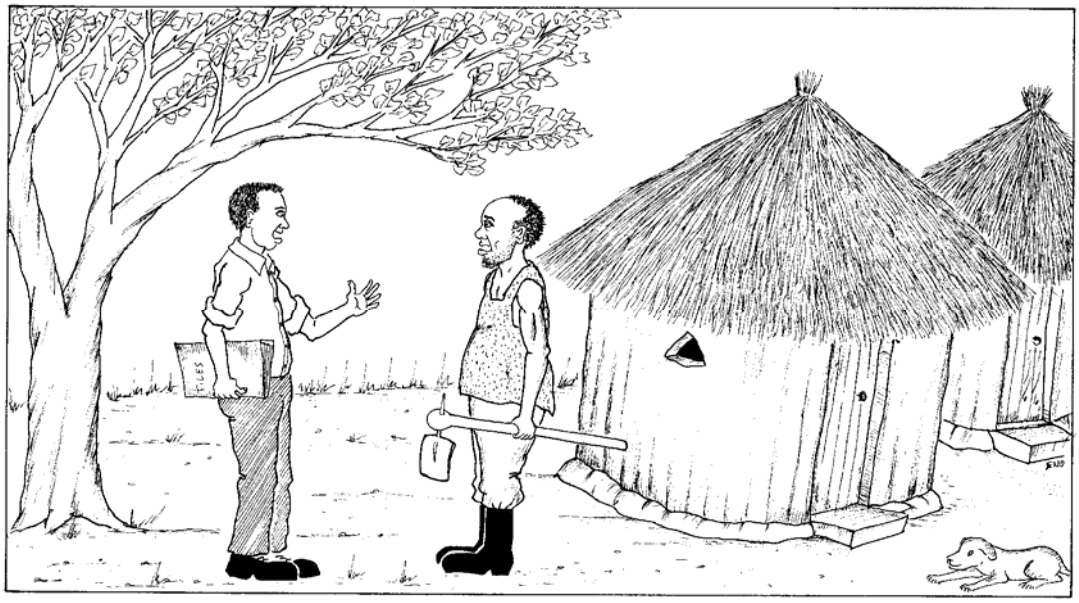
The **actual implementation** of the ecological monitoring is **determined by the monitoring plan** which had been developed in Step 3 and pre-tested in Step 4. It includes the dates at which certain measurements are to be taken. It is important for the NRM Committee to stick to the monitoring plan and to be systematic in the collection of data in order to understand what changes are occurring where and when. However, if in the course of the process, it still becomes obvious that some indicators or measurements can not be used or carried out as planned or relevant or accurate information cannot be obtained, it is still possible to introduce changes. This should be carried out in agreement with the NRM committee and – if possible – with the back-up person.

After data is collected, they need to be put in the record book and **analysed and shared in the NRM Committee** and with other relevant people, such as headmen, representatives of governmental or non-governmental organisations or field staff of the implementing organisation, if still possible. The NRM committees should have at least half-yearly meeting to which they should also invite some of these stakeholders and the back-up person. As far as possible, those who participated in the data collection should take part in the analysis to avoid misinterpretation of the data and findings. In these meetings they should discuss the data on the base of the record books and determine whether the critical thresholds haven been passed. In the case that this has happened ways of adaptive action has to be developed and implemented (Step 6)

As mentioned above, we recommend the introduction of a **back-up mechanism** as some of the tasks associated with ecological monitoring will be difficult to be carried out by communities on their own and some external supervision is necessary. In the case that this could not be done by the implementing organisations, we have collected positive experience with asking a well-known representative of an institution working in the area, either a governmental or non-governmental organisation, or a responsible individual to serve as a **back-up person** in the ecological monitoring. Within their limits, their back-up persons should carry out regular follow-up visits to the NRM committees, which will be easy to do once they work in the region. If possible, the **back-up visits** should be carried out according to the schedule of the monitoring right after the monitoring data were taken or take place at the above-mentioned meeting. These visits of the back-up person to the monitoring committee should aim at

- assessing the overall functionality of the ecological monitoring,
- checking record books and answering to technical questions or problems,
- discussing results and possible determine adaptations in the management plans,
- identifying lessons learnt for future implementations of ecological monitoring.

The back-up person should also be equipped with contacts details form the implementing organisation so that they can be contacted, e. g. in the case that needs for capacity-building arises, or further logistical or technical support might be needed. The back-up person should also be equipped with all necessary material, e.g. this brochure and paper.



What are the results ?

The record books are going to provide evidence of the **environmental trends** to be observed in the area in line with the indictors and methods which were included into the ecological monitoring plan. When follow up visits are carried out, these should be documented.

What needs special attention ?

- It became obvious that the implementation of effective ecological monitoring systems that trace the environmental changes overtime can be best achieved by **proper keeping** of records using the record book provided above. Input such as stationery for record keeping, technical and advisory support to the local leadership and/or natural resource management committees will be necessary to support this process and the necessary mechanisms should be in place as mentioned above.
- If the ecological monitoring is carried out in the context of a development project and constant follow-up by the implementing organisation is possible, probably some environmental facts or trends are identified which will need further discussion or research. Sometimes, developments can also not be clearly understood, for instance with regard to the impacts on or by the NRM activities carried out. If this is the case and if the funds permit, **applied ecological research** can be carried out to back up the ecological monitoring. For instance, some specific test can be undertaken or other ecological research measures planned.

- It is important to be transparent about the process and to **share results.** NRM governing bodies in the area should be made aware of the ecological monitoring system being implemented, should be introduced into the basic principles and aims and should be furnished with the contact details of the implementing organisation and the NRM Committee which is responsible, so that they can contact them in order to get copies of the results. However, they would not be entitled "to check" the record book or to remove them from the communities for copying or other purposes.
- Sometimes, during the implementation of ecological monitoring, further needs for **capacity building** arises. If this is the case, the community or the back-up persons should get in ouch with the implementing organisation. The implementing organisation should take the request serious and should try to mobilise funds for an adequate response to these capacity building needs.
- If the implementing organisation can not continue its work in the project area, also the community should be aware on how to **contact** the implementing organisation in case of urgent problems. Having worked in a project area, an implementing organisation has a responsibility towards the people in this area and the institutions it has been build. If contact is taken to the implementing organisation from the community side, response should be given quickly.

Step 6 – Adaptation of management and land use

What are context and objectives ?

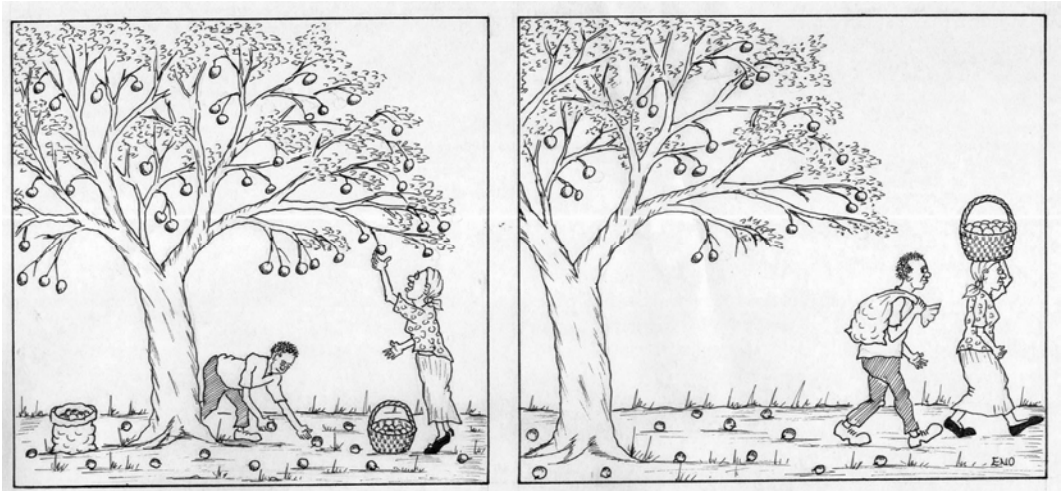
If the critical benchmarks which had been defined in the ecological monitoring plan have been passed, **action** is required and mitigatory measures will need to be developed and incorporated. This will be done by the community, if needed with the support of the back-up authority. Actually, this step is a sub-step of Step 5 as it is also a part of the ongoing monitoring process. However, it is listed separately here, as it represents the final objective of the ecological monitoring and deserves special attention.

This step is aimed to reach the ultimate goal of the monitoring: the **adaptation of management to ecological trends** and challenges, risks and opportunities arising in the ecosystem. The data derived and the analysis carried out is used as a base for **decision-making processes** in the communities which leads to concrete results. If this is the case, the ecological monitoring is used to solve problems and/or to plan future activities. By doing so, it allows for further sustainable development of the project area and the long term viable improvement of livelihood indictors by the sustainable use of natural resources.

How is it done ?

The **connection of indicators and values to decisions** is a difficult step. Decision can refer to questions as how to pursue further use of an forest resource, on whether to stop certain land use practices or projects, on whether to restrict certain activities in an area and on what to recommend to land users. In the case that critical values have been passed, the meeting of the NRM committees have to discuss possible adaptations in the management. These management responses and adjustments can include:

- limiting the total area from which a resource is collected,
- regulating the number or size of the plants being collected,
- reducing the volumes of the material collected, or
- enrichment planting of collected species



The decisions should be drawn on the base of the likely functionality and feasibility of the measure and its potential to address the change identified. If possible, the **headman and other stakeholders** related to the decisions should be consulted and **meetings of the entire community** should be carried out in case of serious situations. Information that had been gained by the monitoring instruments needs to be thoroughly discussed and understood by all community members in order to allow for an informed decision. Discussion in community meetings give all community members a chance to comment and ask questions. This will also increase the ownership for decisions on alterations in the management plan and possible restrictions of resource use. If changes in the management are being decided, the management plan has to be changed accordingly.

As very often decisions on management adjustments are difficult to draw, it is important that the community is able to rely on the **back-up person** or institution for support in this process. The authority in charge for the back-up should possess the knowledge and authority to recommend on possible management options and has to know how to get further support in the case that it is needed.

What are the results ?

As a result of this process the **management plan is reviewed**. This increases the sustainability of the management of the natural resources and will lead to a long-term benefit for rural communities as resources will not deplete and can also be continuously used in the future.

What needs special attention ?

- As this is a very critical process it is recommended to **anticipate indicators** which might be easily trespassed already at the set-up of the ecological monitoring. For these indicators, communities can reflect already at an early point (e. g. in the set-up workshop) together with the field staff on which measures could be undertaken in case of specific developments. In this way, the implementing organisation could give appropriate inputs into this process.
- As the monitoring is going to be continues, the **efficiency of the monitoring** can then be assessed after some years and the suitability of the methods to the objectives can be judged. The implementing organisations which are engaged in intense ecological monitoring activities should follow-up the systems in regular periods of time and should note lessons learned and possible conclusions. This will enable them to use these in other implementations. This is a way of monitoring the monitoring (see chapter 5) and leads to a better usage and appropriate adaptation of the methodology.
- The **back-up institutions** should be aware of the options to get in touch with the implementing organisations and contact partners in case of severe NRM problems arising. Very often, the field staff of the implementing organisation will physically not be far away and can easily and at low cost support with practical or technical advice.

8. What are our guiding principles and experiences ?

Work with communities

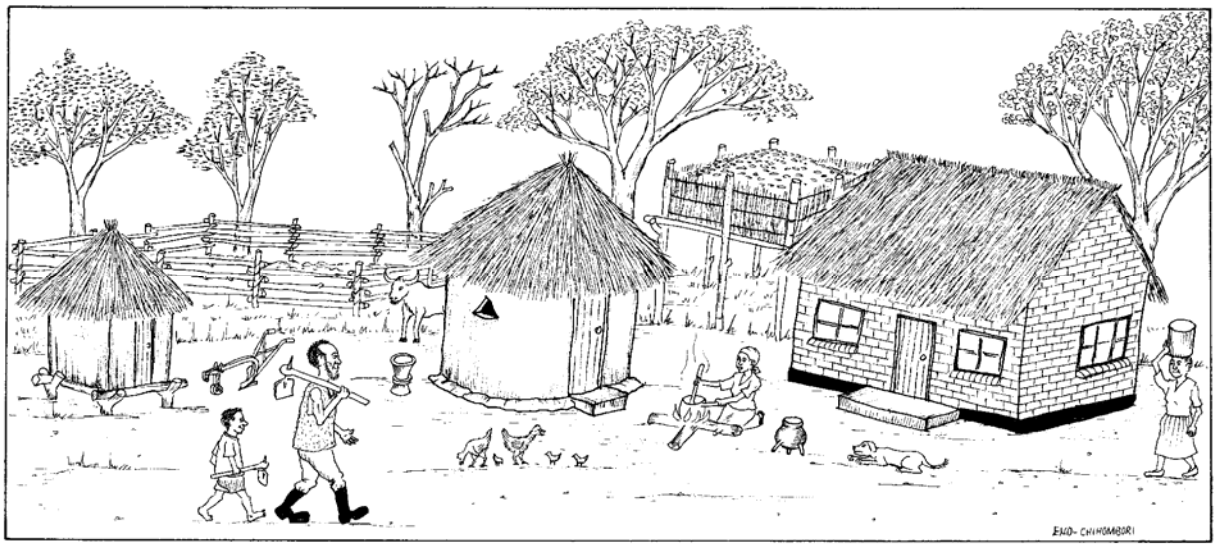
Because of the reasons stated in chapter 5, we decided to adopt a participatory and **community-based approach** instead of a methodology which needs excessive expert input. When we implemented our ecological monitoring, we have seen that the **objectives and methodology of ecological monitoring** are readily shared by the members of the communities. Community members were able to clearly see the benefit of ecological monitoring to them, to identify land use problems, to develop indicators of environmental change and to monitor the environment using these indicators. Being part of a locally relevant ecological monitoring, the people take over a higher responsibility for the planning and implementation of NRM as such. Participatory monitoring

techniques can also incorporate gender-specific aspects, e.g. by gendered resource mapping, and can be easily used as a source for livelihood analyses.

The **commitment and cooperation of the communities**, which we have encountered when implementing ecological monitoring, was impressive. However, we have seen that in order to be accepted, ecological monitoring systems have to be adapted to the local and cultural context. For instance, they have to respect traditional resource management schemes and need to include village authorities. In order to set the base for wide community support, it is usually important to give the local chiefs and elders a central role as advisors and supervisors in the process.

Many practitioners argue that community-based monitoring can help to meet some information needs necessary for NRM but it can not meet them all. We also saw that for a functioning monitoring system **expert knowledge** also needs to come in the set-up of the monitoring and possibly the evaluation and interpretation of the trends. This is the reason for which we have included the back-up mechanism. However, we definitely consider community-based monitoring as the best monitoring method in many developing countries, where technical and scientific data are poor and inadequate, NRM measures often fail and human and financial resources are limited. In this context, it is important to stress the need for knowledge support and building of the capacity and skills of local organisations to design and implement applied ecological research.

In this context, it is important to note that in many countries, also Zimbabwe, most of the **management of natural resources** is carried out **informally.** Ecological monitoring entails a certain formalisation, which may in some cases be first met with hesitations. Accordingly, it is important to design the monitoring and to formulate the indicators together with the communities on the base of an understanding of the linkages of sustainable development and long-term conservation. Only if resources are preserved, they can be used in the future. Ecological monitoring is not to be seen as a measure which means to limit extraction and thus hampers development efforts, but as a way of wise planning. This has to be very clear, as there cannot be any ecological monitoring against the will or the interest of the communities.



Validity and prediction

It has become clear in our work that community-based ecological monitoring has to be rather orientating on **plausibility and pragmatic action** than on scientific accurateness. There is an unavoidable tension between the practical limitations in data collection in the context of a rural development initiative and the desire to be scientifically rigorous. We should be conscious about the need to produce usable results after a short period and be clear about the methodological limitations we have, but should however strive for the highest possible accuracy.

We will also have to accept that ecology deals with complex dynamics and relationships. We will never be able to predict anything with certainty but only with **probability.** For this reason, all effects of adopted action should be re-monitored in order to make sure that they lead to the desired results and NRM measures have to be carefully planned and designed.

Late introduction of ecological monitoring

Out of different reasons, sometimes ecological monitoring can not be introduced at the start of a development initiative but it will be introduced **during the process of implementation**. Maybe this is because the need for ecological monitoring is only recognised at a later stage or certain ecological challenges are encountered which need to be constructively dealt with. Having a mid-project introduction of ecological monitoring clearly holds **advantages and disadvantages**. On the one hand, the monitoring plan and procedures can incorporate previous experiences and challenges that had been already identified. It can build on an established working relationship with the community and very often also on a higher level of awareness. On the other hand, when starting the ecological monitoring late, negative effects caused by the project at its start can not be recorded and comparison against a baseline before the start of the project is not possible. Ecological monitoring can even be implemented towards the end of the project. However, two to three months will be necessary to carry out the crucial components of Steps 1 to 4. We even introduced ecological monitoring as part of the exit strategy in some of our projects.

With regard to the methodology described above, the preliminary Steps 1 and 2 might not be necessary anymore at a late implementation of ecological monitoring. They might have been executed already. The other steps could be followed just the same way as they are described here.

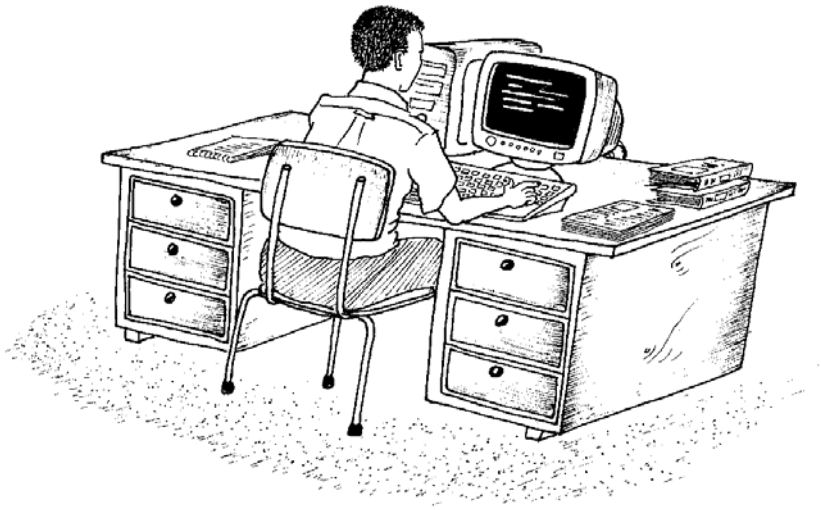
Impact attributions

Most ecological monitoring systems are set up in the context of a development initiative with different sorts of actions and interventions. It is often difficult to specify the relation of the development initiative to the trends which are observed. However, often it is plausible that some of the NRM trends detected and new challenges are not directly or indirectly caused by the development initiative. For instance, certain species in a woodland might decrease in numbers over time without a clear relation to the harvesting of forest fruit which is promoted. It is not easy to understand **what impacts on what**. It is advisable to implement **precautionary measures**, even if impacts are not certain and the threat does not seem to be too high but negative trends should not

be attributed automatically to the projects. Even if certain NRM challenges are not caused by a development initiative, they very often threaten the future availability of the product or the success of the development intervention. Accordingly, they should also be addressed by efforts form the stakeholders.

Use of GIS and GPS

Taking **GPS data** (Global Positioning System) and processing them by Geographical Information Systems (GIS) offers a good possibility to collect, compile and process spatial data related to a project and make them available to implementers. GIS applications make comparisons with other projects easier and are helpful in order to prepare maps for publications. The use of GIS is getting increasingly important, also in ecological monitoring. Though the technical base (hardware) is now widely progressed and affordably available, GPS and GIS usage is **not yet suitable for community-use** and is not recommended for the context for which we have designed this monitoring. Communities would need special expertise and hardware such as a constant supply with batteries or electricity. There would also need to be a computer for the processing of the data. As the usage of GIS it is not at all a necessary prerequisite for the carrying out of an expedient ecological monitoring, we decided to keep it simple and not to include it here. Of course, in the set-up data and during the baseline studies, data can be collected, compiled and analysed using GPS or GIS.



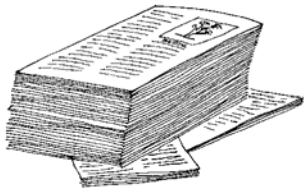
Lack of baseline data

For us, the lack of baseline data often posed a special challenge. Usually, baseline data from a certain time back is used in ecological monitoring. It helps to compare and determine impact or to understand the full extent of environmental changes in a given time. In the context of developing countries, this is often not possible. This should not be a reason for not implementing ecological

monitoring. As we show here, a monitoring procedure can also side-step the need for a baseline. It is always possible to indicate **direction of change**, i. e. improvement or decline, against a previous measurement or a desired condition. For instance, as here, the first year of monitoring data can be used as a baseline.

Coherence of instruments

Organisations working in NRM mostly have developed their **specific tools and instruments** for NRM which are based on their experiences and adapted to the projects they run. Wherever possible, ecological monitoring should not be simply added to the toolbox, as this involves unnecessary extra work and would not correspond with the other methods. It is more recommendable that the ecological monitoring is included into the existing instruments and is **harmonised** with them into a coherent process of implementing NRM.



For instance, where we have developed already a **Community Resource Management Plan** (CRMP), both instruments are now linked to each other. CRMPs are developed together with the communities and compile ecosystem risks as a base for indicator development. The process is largely comparable to the procedures described under Step 2. Ecological monitoring is now used to follow up to the CRMP and to assess the impact of corrective measures. In new projects, wherever possible CRMPs are developed together with the implementation of ecological monitoring, in the community meetings. The interconnection of the instruments reduces the time invested by the community and helps them to understand the different aspect of a sustainable development initiative.

Many organisations such as SAFIRE also carry out **applied ecological research** and/or collaborate closely with research institutions. Ecological monitoring can be a part and source of applied ecological research as it shows long-term impacts of interventions and documents how ecosystems develop under different conditions. The analysis of results from ecologic monitoring can also lead to findings on ecosystem dynamics and impact chains in ecosystems. If ecological research has been carried out in a certain area already, the results should be used in the set-up of the ecological monitoring (Step 1).

Ecological monitoring in an organisation

When carried out in the context of development projects, ecological monitoring should be integrated into the **overall M+E system** of the implementing organisation. The indicators from the ecological monitoring framework inform about project impacts from an ecological perspective and allow for organisational learning (see chapter 4). Results from ecological monitoring can also show progress towards the strategic goals of the organisation. Accordingly, the M+E Section and Officers of an organisation should be included into the process of setting up an ecological monitoring.

As mentioned above, the indicators and the monitoring plan for the ecological monitoring can vary according to the objectives pursued with the ecological monitoring. For instance, the monitoring can

be closer linked to the **impact of the intervention** of an organisation, such as we did in some projects of SAFIRE. However it has to be noted that in this case the indicators need to be determined rather directly by the implementing organisation, which would not make it an entirely community-based process anymore. The interest of the community in the monitoring might be become more limited as the monitoring of these indicators would not necessarily be directly beneficial to them.

For larger organisations, ecological monitoring can help to determine the content of possible **applied research.** Issues which arise from the ecological monitoring and needing further interest or investigation could be communicated to universities or specialised staff of the Research and Development (R+D) Department.

9. What else to keep in mind ?

At the end of this manual we would like to give some general hints for the implementation of ecological monitoring:

- **Be clear about the reference area !** When carrying out ecological monitoring it is very important to be clear about the reference area and to consider this aspect when working with communities or interviewing informants. Practically this is more difficult than it sounds, but it is an absolute requisite for collecting reliable and comparable information. Sometimes but rarely, the village and ward areas are demarcated by rivers. Very often people have different ideas about the borders of the harvesting area or the village. It is foremost in the responsibility of the staff of the implementing organisation to introduce this accurateness at the start of the project and to stress the point at community meetings.
- **Be clear about the reference period !** Similar care should be taken with clarification of the reference period in the ecological monitoring. Usually ecological monitoring does not look too far back in history, but deals with limited time spans, over which changes are being observed. Usually these time spans will be one year and there is no alternative to being accurate about these.
- **Be transparent to the communities !** It is necessary that at the start of the implementation of the ecological monitoring the officer clearly explains the process and its aims and explains the purposes of the visits and all the activities that are intended to be carried out in the project area. They also have to be agreed with the local leadership. The officer should repeat these at every visit and thus help the community to understand the order and sequence of the activities. There can be no ecological monitoring without community commitment.
- **Stick to contact persons and key informants !** We have made the experiences that it is very helpful to work with the same contact person and informants over time. Very often, they can also

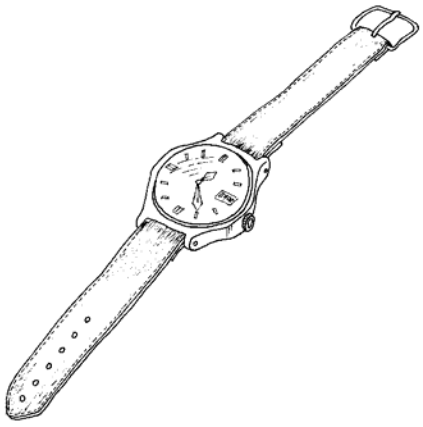
take over a lead responsibility for the monitoring. This will standardise the data and ensure their reliability. It is recommendable to choose members of the following groups as key contact partners: headman, extensions staff, members of enterprise group, district representatives. There should be at least two informants from each village or subset of area in order to come up with objective information and to reduce bias. It has to be tried to also include disadvantaged groups.

- **Cooperate with others !** Ecological monitoring can improve NRM strategies and be a tool for overall landscape management. In this context, it can well be argued that ecological monitoring should be set up by governmental agencies, such as Forestry Commission. In fact, in many countries, ecological monitoring was introduced by these agencies. However, sometimes, they might not have the means at hand or might lack the expertise or the specific mandate. For this reason it also seems recommendable to have an NGO setting up the monitoring. However, intense cooperation and transparency with governmental structures shall be sought. Other stakeholders should be informed about the activities, their results and their desired impact. That enables them to expediently contribute to the data collection, to be able to use the results, and to join into common efforts. We have found it helpful to present the ecological monitoring in district-level meetings and discuss the results and the potential role of other stakeholders.

- **Be patient !** As this manual shows, the set-up of an ecological monitoring is a quite long process which needs several steps. The ecological monitoring can not be set up during one community visit. Once an ecological monitoring has been well developed and set up it, and the capacity for the communities has been build, it will not need much more input, but these first steps have been carefully and patiently implanted. If the set-up has not been done carefully enough, the ecological monitoring is likely to fail. Because they are so important, they also take so much space in this manual.

- **Again: Be patient !**

  Ecological monitoring is a medium-term project. The most valuable results will only be produced after the collection of two or more data sets which allows for the analysis of environmental trends. For evaluations for project management, similar time spans need to be expected.



Further reading

Though ecological monitoring is getting a more central role in NRM-related development projects, there is not yet a lot of literature on the issue. As the evaluation of the instruments is still at the start, any new experience on successful examples or best practices are welcome in the international discussions on ecological monitoring.

This manual and the work we have done mainly draws on the following technical **literature on ecological monitoring**:

- ABBOT J. and GUIJT I, 1998. Changing views on change: Participatory Approaches to monitoring the environment. SARL (Sustainable Agriculture and Rural Livelihoods) Discussion Paper No.2. IIED, London. Download: www.virtualcentre.org/en/dec/toolbox/Grazing/sarl2.pdf
- GUIJT I, 1999. Participatory monitoring and evaluation for natural resource management and research. Socio-economic Methodologies for Natural Resource Research. Natural Resource Institute, Chatham. Download: www.nri.org/publications/bpg/bpg04.pdf
- PETERS C.M., 1996. The ecology and management of non-timber forest resources. World Bank Technical Paper. World Bank, Washington.
- SPELLERBERG I.S., 2005. Monitoring Ecological Change. Cambridge University Press, Cambridge.
- WALSCH A., 2000. Participatory Environmental Monitoring: Facilitators Manual. German Foundation for International Development, Bonn.

The first two of these documents can also be downloaded form the internet with the links provided.

We have developed a number of **internal documents**, which get into details concerning our approach and adapt it to specific circumstances. These are:

- FRÖDE A., 2006. Ecological Monitoring and Data Collection in SAFIRE Baseline Report. SAFIRE, Harare. Internal document.
- FRÖDE A., 2006. Ecological Monitoring baseline Visit to Nyanga, 28 August – 30 August, Outcomes and Lessons learnt. SAFIRE, Harare. Internal document.
- MAKWIRAMITI P., MASARA C. and FRÖDE A., 2007. Ecological Monitoring Visit to Nyanga (FORD), 13 December – 15 December 2006. Outcomes and lessons learnt. SAFIRE, Harare. Internal document.
- FRÖDE A. and KHUMALO S.G., 2007. Participatory ecological monitoring in the context of for medicinal plants extraction – The SAFIRE approach. SAFIRE, Harare. Internal document.

They are not publicly available. However, some of the conceptual information included can be extracted for usage by outsiders. Contact can be taken with the authors in the case of interest. We also plan for a scientific publication which will explain in detail about the process.

We do not want to confuse the reader by a too wide range of references and recommended literature and there are no specific webpage son ecological monitoring in the development context. For this reason, we only want to propose starting points for finding information on some aspects related to ecological monitoring in the internet. From these **webpages** you can get to various others.

- Livelihoods approach and analysis: http://www.livelihoods.org/
- Monitoring and Evaluation: http://topics.developmentgateway.org/evaluation
- Forestry and NRM: http://www.fao.org/forestry/index.jsp
- Biodiversity and NRM: http://www.iied.org/NR/index.html

Other literature used for the compilation of this manual includes:

- ARNOLD J.E.M. and RUIZ PÉREZ M., 2001. Can non-timber forest products match tropical forest conservation and development objectives ?. Ecological economics 39: 437-447.
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- FAO, 1995. Non wood forest products for rural income and sustainable forests. Non-wood forest products series 7. FAO, Rome.
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- HOBBS R.J. and MORTON S.R., 1999. Moving from descriptive to prescriptive ecology. Agroforestry systems 25: 43-55.
- KREMEN C., MERENLENDER A.M. and MURPHY D.D., 1994. Ecological Monitoring: A Vital Need for Integrated Conservation and Development Programs in the Tropics. Conservation Biology Vol. 8, No 2: 388-397.
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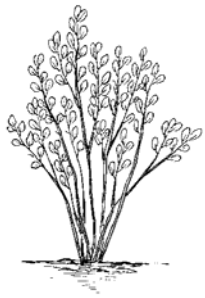
SAFIRE and its ecological monitoring

The **Southern Alliance for Indigenous Resources (SAFIRE)** was established in 1994 to assist rural communities in the development of self-sufficiency through the improved management of their natural resource base. It is a NGO based in Harare/Zimbabwe, deriving its membership from a number of local and international organisations, grass-roost development agencies, government institutions, international organisations and individuals. Operational in close to 20 districts in Zimbabwe, SAFIRE runs a head office in Harare, three regional offices in Masvingo, Mutare and Harare and an office in Lusaka/Zambia. SAFIRE also provides support and training to community-based natural resources management programmes throughout Southern Africa emphasising the use of participatory development methodologies. In addition SAFIRE contributes technical assistance to environmental issues in refugee situations in Africa and is currently actively collaborating with patterns in Botswana, Malawi, Mozambique, Namibia, South Africa, Swaziland and Zambia.

The promotion and support to small-scale commercialisation of a wide range of **non-timber forest products** is a core area of SAFIRE's activities. Being aware of the potential impacts of the use of forest resources on the ecosystem, SAFIRE has since its establishment developed and used a broad range of ecological tools and NRM instruments in order to appropriately consider ecological aspects in the planning and implementation processes of its NTFP-related projects.

In order to further expand its activities with this regard, it was decided in October 2005 to strengthen the ecological monitoring activities and to introduce a coherent approach to ecological monitoring. The first step in the introduction of **ecological monitoring in SAFIRE** was the compilation of a baseline study on opportunities and proposed steps for the further mainstreaming of ecological monitoring in the organisation. The baseline study was build on an in-depth review of SAFIRE research and project documents, in-depth interviews with SAFIRE staff and international specialists and a review of international literature. After an organisation-wide discussion process which led to an adoption of the reviewed concept, the NRM Technical Team of SAFIRE decided for a SAFIRE project in the Eastern Highlands of Zimbabwe to serve as a pilot site for the implementation of ecological monitoring. In this project area, the steps as described in this manual were implemented from July 2006 to June 2007. The process was closely monitored and documented in order to assess and expand its appropriateness. On the base of the positive experiences from the pilot implementation, from early 2007 onwards ecological monitoring was also introduced in four other project sites. Throughout the process, input was sought from scientists and practitioners in order to make the instrument as effective as possible and adapt it to the specific needs of SAFIRE projects and the conditions in Zimbabwe. The experiences for all these implementations form the base of this manual.



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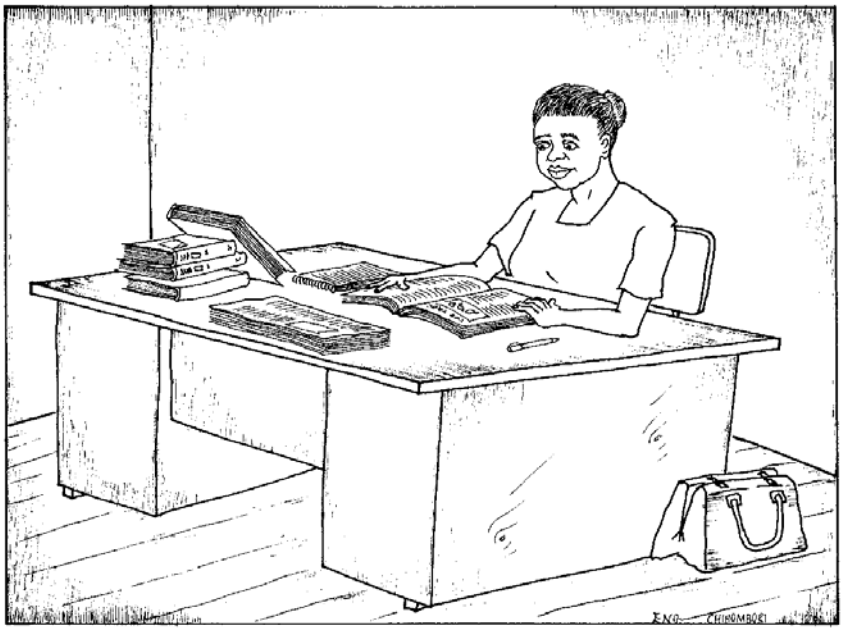
List of Abbreviations

AREX	Agricultural Research and Extension
BfN	Bundesamt für Naturschutz (Federal Agency for Nature Conservation), Germany
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (Federal Ministry for Economic Cooperation and Development), Germany
CBNRM	Community-Based Natural Resource Management
CRMP	Community Resource Management Plan
DBH	Diameter at Breast Height
DED	Deutscher Entwicklungsdienst (German Development Service)
DWAF	Department of Water Affairs and Foretsry, South Africa
FAO	Food and Agriculture Organisation of the UN
GIS	Geographical Information System
GPS	Global Positioning System
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Co-operation)
HH	Household
IUCN	The World Conservation Union
M+E	Monitoring and Evaluation
MPSG	Medicinal Plants Specialist Group (IUCN)
NGO	Non-governmental Organisation
NRC	Natural Reseouce Commitees
NRM	Natural Resource Management
NTFP	Non-Timber Forest Product
PRA	Participatory Rural Appraisal
PSP	Permanent Sampling Plot
SADC	Southern African Development Community
SAFIRE	Southern Alliance for Indigenous Resources
SARDC	Southern African Research and Development Centre
SSC	Species Survival Commission, IUCN
TRAFFIC	Trade Records Analysis of Flora and Fauna in Commerce
UNEP	United Nations Environment Programme
WCMC	World Conservation Monitoring Centre
WWF	World Wide Fund for Nature
ZINATHA	Zimbabwe National Traditional Healers Association

Annex



Annex 1 – Sample data collection form for resource assessment

Vegetation Transect Summary –Woody plants

Area: **Transect #** **Plot #:** **Position:**

Site Characteristics:

Tree Species	**Status**	**Height**				**Canopy size**	**Diameter classes (cm)**						**Bark harvesting**			**Number of fruits**			
		Regeneration < 30 height	<2	2-5	>5		Sapling >30 height, < 10 dbh	<10	11-20	21-30	30+	Tot	None	Ave.	Severe	0-50	50 < 100	100-1000	> 1000
Total																			

Vegetation Transect Summary - Herbaceous cover

Area: Transect # Plot #: Position:

Site Characteristics:

Multistemmed herbs	Harvested	Size			Stem Height				
		# of stands (clumps)	# of clumps (genets)	# of stems (ramets)	Under ground	<30 cm	30-100 cm	101-150 cm	>151 cm

Annex 2 – Sample CRMP

Livelihood Activity	Resource Base	Problems & Constraints	Adaptive Management				
			Changes due to activity	Mitigatory measures (agreed solutions)	Control systems	Time Frame	Responsible authority
Cutting fuel wood ❑ Cooking ❑ Brick curing ❑ Heating	Musasa Minhondo, Mugodo, Mususu	❑ Burning crop residues and cow dung. ❑ Shortage of shade. ❑ Wind intensity and effects increases. ❑ Shortage of medicines.	❑ Cutting living trees. ❑ Tree reduction in numbers. ❑ Being affected by the cold. ❑ Whirlwinds	❑ Cutting dead (dry) trees ❑ Planting new trees ❑ Not cutting all the trees when clearing the fields	❑ Cut only on areas demarcated by the committee ❑ Cut only dead (dry) trees ❑ Family should cure(burn) bricks once a year. ❑ Cut fuel wood for domestic use only and not for selling.	Two years	❑ NRC members ❑ Headmen ❑ Chief
Makoni tea processing	Leaves, collect those which have turned yellow, and sun dry them for a day .Put them in a sack, sprinkle some water and leave them over night and dry them again	❑ Fire, ❑ Wildlife and insects. ❑ Too much water cause them leaves to decay	❑ Makoni tea shortages. ❑ Income shortages to the community.	❑ Transplanting in the fields ❑ Sowing seeds in nurseries to whether they germinate. ❑ To identify the pests.	❑ Avoiding veld fires ❑ Avoiding uprooting of plants ❑ Implementing policies	From March to June in the same year.	❑ Committee ❑ Headmen ❑ Chief ❑ N.R.C
Construction of houses.	❑ Soil for plastering the house ❑ Trees:mugodo, mususu, mutondo, mupfuti ❑ Thatch grass ❑ Water to wet the mortar(soil) ❑ Stones for the foundation.	❑ Cutting trees Burning grass ❑ Bark shortages	❑ Grass can not grow effectively alone without trees. ❑ Gullies increases in numbers ❑ Desertification occurs	❑ Harvesting regulation s e.g. two stacks of grass per person.	❑ Planting new trees before the existing stock gets finished. ❑ Filling up gullies. ❑ Avoiding cattle to graze on the grass ❑ Cutting of only mature grass., ❑ Avoid forest fires	Three seasons before we harvest trees -grass	❑ Authorities ,a community development committee formed ❑ Headmen

Medicines	Sausage tree, Blood wood fruits bark (treatment for eye cataracts) Chirorwe-chinorapa mhepo munhu arwarisa	❑ Bloodwood getting vulnerable , people over exploiting ❑ Cutting the tree for furniture and carvings	❑ Extinction ❑ Kamukana kuti murwere osveka ndoenda kumushonga	Make sure you do not collect all when harvesting the medicine.	❑ Collect the medicine to be used only for a few days. ❑ Plant more trees to replace those that have been cut down	Allow the plant to regenerate for one year with no disturbance.	❑ Headmen ❑ ZINATHA
Wood carving (Craft production)	Mitondo –for carving of *migura*, misusu-for making yokes agricultural implements, musendi-for making cooking sticks and spoons Bloodwood for making doorframes and chairs	Digging the fields will kill the roots and the plant can no longer regenerate	Tree species used for wood carving become extinct	Conserving our resources and for regulations	Building a committee for sustainable resource conservation	From this day onwards we will try our best to conserve our resources according to the lessons that we have learnt	Village scouts
Mushroom	Chihombiro, shokova, dindindi, ndebvu dzasekuru, nhedzi, nzeve yambuya	❑ Mushroom have reduced in quantity	Income generation from the sell of mushrooms	Need for better markets – sometimes we spend the whole day selling in the streets and the people buy for small amounts of money .	To be self reliant/private sellers and to dry the mushrooms on our own Stopping tree cutting and veld fires Avoid too talking when gathering mushrooms	January →March→ February The only time for harvesting each year	WholeCommunity and village scouts
Cutting grass	Grass- -*mbingwe* -sweeping brooms -*mbuyi*	❑ Burning of veld fire ❑ Shortage of better markets and the customers are few ❑ Some people come and steal and sell somewhere else	❑ Reduction in grass availability ❑ Reduction income to the community	Trainings on grass cutting methods, seed preservation and grass planting techniques	❑ Cut the grass to the sustainable limits ❑ Cut only in areas where there is plenty of grass	❑ Cutting should be done in June when the grass has matured ❑ Community should meet together suggest a price for the thatch grass	❑ Thatch Grass project committee ❑ Headmen ❑ N.R.C

Annex 3 – Ecological Monitoring Plan form

Indicator	Critical value	NRM Challenge addressed	Baseline data	First monitoring period	Frequency	Methods	By who

Annex 4 – Sample Ecological Monitoring Plan

Indicator	Critical value	NRM Challenge addressed	Baseline data	First monitoring period	Frequency	Methods	By who
Number, stem height and leaf size of Fadogia individuals in *Fadogia* Sample plots	More than 50 bushes not existing anymore	Availability of *Fadogia*	December 2007 *(Data collection: December 2007)*	December 2007 - December 2008 *(Data collection: December 2008)*	Yearly	Physical assessment	Enterprise Group
Productivity per plant (amount of tea produced)	Average productivity under 0.3 kg dry leaves per plant	Availability of *Fadogia*	2006 Harvesting season *(Data collection: December 2006)*	2007 Harvesting season *(Data collection: December 2007)*	Yearly	Key informant interviews	Enterprise Group
Overall harvesting volume of Makoni Tea enterprise (Volume)	Less than the 2005 level	Availability of *Fadogia*	2006 Harvesting season *(Data collection: December 2006)*	2007 Harvesting season *(Data collection: December 2007)*	Yearly	Enterprise data	Enterprise Group
Amount of *Fadogia* leaves typically harvested by one person on one day	Less than 2 kg	Availability of *Fadogia*	2006 Harvesting season *(Data collection: December 2006)*	2007 Harvesting season *(Data collection: December 2007)*	Yearly	Key informant interviews	Enterprise Group
Average walking and harvesting time in the collection areas (Distance, time)	Average walking time more than 2 hours	Availability of *Fadogia*	2006 Harvesting season *(Data collection: December 2006)*	2007 Harvesting season *(Data collection: December 2007)*	Yearly	Key informant interviews	Enterprise Group
Number and individual height of *Myrothamnus* individuals in PSPs	Only few with stems with more than 40 cm height	Availability of *Myrothamnus*	June 2007 *(Data collection: June 2007)*	June 2007 - June 2008 *(Data collection: June 2008)*	Yearly	Physical assessment	NRM Commitee

Species distribution in PSPs	Alien species spreading fast, few re-growth from main tree species	General ecosystem development	December 2006 *(Data collection: December 2006)*	December 2006 - December 2007 *(Data collection: December 2007)*	Yearly	Inventory	NRM Commitee
Signs of anthropogenic disturbance on PSPs (Cuttings, removals of trees, harvesting)	More than 10 living trees with more than 2 m height removed from plots, more than a quarter of the trees signs of cutting and bark harvesting	Deforestation	December 2006 *(Data collection: December 2006)*	December - June 2007 *(Data collection: June 2007)*	Half-yearly	Visual assessment	NRM Commitee
Clearance of woodland (Size, Cause)	More than 10 ha loss per year	Deforestation	December 2006 *(Data collection: December 2006)*	December 2006 - June 2007 *(Data collection: June 2007)*	Half-yearly	Key informant interviews	NRM Committee, Headmen
Area under Tobacco (area)	More than 10 ha under tobacco	Deforestation	2006 Agricultural Season *(Data collection: December 2006)*	2007 Agricultural season *(Data collection: June 2007)*	Yearly	Key informant interviews	AREX
Early fires per dry season (until 31 July) (number of fires, area burnt, woodland type burnt)	Area burned bigger than 5 ha	High rate of fire	2006 Dry season *(Data collection: December 2006)*	2007 Dry season *(Data collection: December 2007)*	Yearly	Key informant interviews	NRM Committee, Headmen
Late fires per dry season (after 1 August) (number of fires, area burnt, woodland type burnt)	Area burned bigger than 5 ha	High rate of fire	2006 Dry season *(Data collection: December 2006)*	2007 Dry season *(Data collection: December 2007)*	Yearly	Key informant interviews	NRM Committee, Headmen

Annex 5 –Sample record book

Indicator	Specification	Value 1	Value 2	Value 3	Value 4	Value 5	Critical value	Observations
Fire		2006	2007	2008	2009	2010		e. g. number of fires, woodland type
	Total area burnt by early fires (until 31 July)							
	Total area burnt by late fires (after 1 Aug)							
Land conversion		2006	2007	2008	2009	2010		e. g. Causes
	Total area converted from woodland to other uses (agriculture, building)							
Erosion		May 2006	May 2007	May 2008	May 2009	May 2010		
	Total number of erosion gullies in deeper than 1m							
Other NTFP uses (crucial NTFP's)		2006 Season	2007 Season	2008 Season	2009 Season	2010 Season		e. g. Distance walked and trends in availability
	Average amount of Mazhanje harvested per HH							
	Average amount of mushrooms harvested per HH							
Legal/illegal collection of medicinal plants		2006	2007	2008	2009	2010		
	Number of poaching incidents reported per year to NRM committees							
	Number of permits distributed for collection of medicinal plants							
Firewood		2006	2007	2008	2009	2010		
	Trends in the availability of firewood							

Annex 6 – Sample PSP Record Form

Data Collection – Permanent Sampling Plots

Plot #:		Area:	
Date and time of data collection		GPS coordinates:	
Ecological characterization			
Signs of anthropogenic disturbance			
Signs of erosion			
Signs of fire			
Number of *Eucalyptus* sp. and *Acacia mearnsii* individuals in the plots			
Other remarks			

Species distribution - Trees

Tree Species	Number of individuals	Height				Canopy size	Diameter classes (cm)						
		Regeneration < 30 height	<2	2-5	>5		Sapling >30 height, < 10 dbh	<10	11-20	21-30	30+	Tot	Signs of use/Harvesting

Species distribution - Herbaceous cover

Species	Quantity (Brown-Blanquet)*	% cover	Number of genets/individuals	Height <30cm	Height 30-100cm	Height 101-150cm	Remarks

* **Braun-Blanquet values:**

R = **1 individual** per plot, rare also in the surroundings

+ = **2-5 individuals** per plot, **cover under 5%**

1 = **5-50 individuals** per plot, **cover under 5%**

2 = **50+ individuals** per plot and **cover under 5%** **OR** **Number** of indiv **irrelevant**, **cover 5-25%**

4 = **Number** of individuals **irrelevant, cover 50-75 %**

5 = **Number** of individuals **irrelevant, cover 75-100 %**

2m = more than 50 individuals, cover under 5%

2a = Number of individuals irrelevant, cover 5-15%

2b = Number of individuals irrelevant, cover 15-25%

3 = **Number** of individuals **irrelevant, cover 25-50 %**