Global Environment Division

Guidelines for Monitoring and Evaluation for Biodiversity Projects

June 1998

Contents

Executive Summary

Biodiversity projects are designed on the assumption that project interventions will lead to conservation of key biological resources. Monitoring and evaluation are the primary mechanisms to assess whether a project is meeting its targets and objectives. These guidelines are intended primarily to assist World Bank task teams and consultants in the design and implementation of monitoring and evaluation (M&E) plans for biodiversity conservation projects or projects with biodiversity components. It is hoped that they may also serve as useful reference materials for government agencies, non-governmental organizations and others involved in the design, implementation or evaluation of biodiversity projects.

M&E plans are mandatory for all Bank projects. They must be developed as integral elements of projects to provide information on whether project interventions are successful in achieving project objectives and on how social, economic, political and institutional factors are affecting project performance. Monitoring and evaluation for biodiversity projects involves two kinds of indicators: *implemen tat-ion performance indicators* (project inputs and outputs) and *project impact indicators* (project impact on biodiversity). These guidelines focus primarily on the latter *(impact indicators).*

An M&E plan is a detailed program of work which defines what monitoring activities will take place, when and by whom, and how that information will feed back into management decisions. The plan should include an estimate of costs of implementation, and identify training and capacity building needs among the staff and institutions responsible for this M&E. The plan should also spell out how M&E activities begun under the project will contribute to the establishment of a long-term monitoring and evaluation capability in the host country. In the developing country context it is especially important to develop an M&E plan that is simple, inexpensive, and sustainable in terms of the financial, institutional, and technical resources available.

A biodiversity M&E plan should, therefore:

- answer a clearly stated set of questions (i.e. have clear objectives);
- state clearly what indicators will be chosen;
- specify how often monitoring and evaluation will be done, and by whom;
- outline any necessary training or financial inputs that are required;
- state the intended audience for the evaluations;
- specify how information will feed back into management decisions; and
- state clearly the decision points at which action must be taken to address negative trends.

Monitoring of biodiversity is not the same as measuring biodiversity. Measuring biodiversity provides a snapshot of biodiversity (e.g. number of species present) at the time of measurement. Monitoring is a continuing process which allows managers to identify changes and trends over time so that they can assess whether interventions are achieving biodiversity goals and adapt management accordingly. While preparation of a biodiversity project may require a comprehensive biodiversity survey, future monitoring does not need to update this full set of data. In most cases managers are

concerned with monitoring trends rather than measuring absolute values.

Scoping of the M&E plan should be done during project preparation. Experience has shown that there is seldom sufficient information available at this stage to prepare a detailed M&E plan. Nevertheless it is important to develop either the terms of reference for preparation of an M&E plan, or the preliminary outline of the M&E plan. This provides a basis both for the costing of M&E project components and for the development of the full M&E plan as soon as possible after project commencement. Further development and refinement of the M&E plan can be done as necessary during project implementation, based on local experience and field testing.

It is particularly important to define the spatial and temporal scales of monitoring activities. Because biodiversity management deals with ecological processes which are generally longterm (e.g. changes in numbers of a population of a key species) changes resulting from management interventions may be slow to emerge, sometimes beyond the project time frame. This suggests the need to establish a monitoring framework that will extend beyond the project term and, if appropriate, feed into a national monitoring system. The appropriate spatial scale for project monitoring will be determined by the specific goals and objectives of the project, and depend on whether it focuses at the landscape, ecosystem or species level.

The most important aspect of any M&E project is the choice of suitable and meaningful indicators. Clearly identifying the assumptions for project interventions will help identify indicators for monitoring both changes in threats and the effectiveness of project interventions in mitigating those threats. Most importantly, indicators must be practical and realistic, and should, whenever possible, be meaningful at both the national and site level, as well as consistent with the main objectives of the project. For example, monitoring changes in forest extent and integrity may provide useful information on park integrity, but will not provide information on the conservation status of tigers or other wildlife if the main threat is poaching.

Most threats to biodiversity result from human activities which, in turn, depend on social and economic factors. Monitoring of socioeconomic factors, therefore, is an important part of biodiversity M&E. However, it is necessary to recognize that the relationships between biodiversity health and the socioeconomic characteristics of human groups causing impacts are far from clearly established. In fact they are likely to vary from one location to another. This needs to be taken into account in designing M&E plans and particularly in identifying and interpreting socio-economic indicators. Similarly a range of institutional factors can impact on biodiversity health and the effectiveness of biodiversity management and should also be monitored.

Preparation of M&E plans and identification of relevant indicators should, as much as possible, involve those communities and institutions likely to be affected by project interventions. The identification of indicators and appropriate sampling regimes should also take into account existing monitoring programs and data sets at the local and national level, capacity at these levels, and the need to establish agreed sampling and recording protocols at the national level. Consistency of monitoring approaches across local areas and protected area systems should have a high priority.

A meaningful and operationally relevant biodiversity monitoring system will encompass a broad range of subjects to be monitored, including landscape or species dynamics, socioeconomic factors and community involvement and institutional and regulatory factors. No universal set of indicators will apply to all projects but most projects will be measuring a range of indicators. The specific indicators chosen for any individual project will depend on the particular objectives and goals of that project and the activities that are proposed to meet those goals. For any project it will be important to choose a minimum set of a few indicators that are feasible, useful and relevant to that project and can be sustained with local capacity and resources after the end of the project. Chapter 3 provides general guidance on identifying appropriate biodiversity M&E indicators in different thematic areas while the annexes provide examples to assist in the

development of indicator sets relevant to particular situations.

Monitoring and evaluation are integral parts of biodiversity management and require adequate resources, including budget and institutional capacity, clear institutional responsibilities and reporting mechanisms. It is important to build incentives and capacity to collect, use and maintain data for monitoring and evaluation. Since M&E will require additional capacity, work and budget beyond the lifetime of the project it is important to develop M&E plans that can be resourced sustainably. The information gathered through M&E activities is useful both for assessing the impacts of the individual project and to provide input into the design and implementation of future biodiversity projects and ongoing biodiversity management programmes.

1 Introduction

Monitoring and evaluation (M&E) for biodiversity has been defined as the gathering of data to enable detection of changes in the status, security and utilization of biological diversity for the purpose of improving the effectiveness of management of that biodiversity. Biodiversity can be defined at three different levels (ecosystem, species and genetic) and projects may be concerned with biodiversity at all three levels. The complexity of biodiversity as a concept requires some different monitoring and evaluation approaches to those usually used in other environmental projects.

These guidelines are intended primarily to assist World Bank task teams and consultants in the design and implementation of monitoring and evaluation (M&E) plans for biodiversity conservation projects. It is anticipated that the guidelines will also serve as a useful reference for client government agencies, non-governmental organizations and others involved or interested in the design, implementation or evaluation of biodiversity projects. In general the guidance is aimed at the developing country situation where resources and capability are limited.

A. BACKGROUND

In 1992 the World Bank issued preliminary guidelines for M&E of biodiversity conservation projects financed by the Global Environment Facility (GEF) – *Guidelines for Monitoring and Evaluation of GEF Biodiversity Projects* (World Bank, 1992). At that time, none of the GEF pilot phase biodiversity projects were yet under way. The guidelines, therefore, were based primarily on expert knowledge in the field, After five years of implementation experience, lessons for M&E are starting to emerge. These guidelines update the previous guidance to make them more useful for application at the field level.

The design and execution of M&E plans are guided by the Bank's operational directive for monitoring and evaluation (Operational Directive 10.70). GEF-financed projects must also respond to GEF standards for monitoring and evaluation and reflect GEF's operational strategies and programs *(Operational Strategy, 1996).*

The revised guidelines are designed to recognize the particular characteristics and complexities of assuring biodiversity conservation - whether in biodiversity conservation projects or as a necessary consideration in a wider range of project types which impact on biodiversity. The guidelines provide some background to M&E of biodiversity, discuss some of the major issues, and provide advice on formulating a biodiversity monitoring plan and selecting appropriate indicators.

The technical aspects of formulating an M&E plan are addressed in Chapter 2, including key considerations of temporal and spatial scales as well as data collection, storage and processing. Chapter 3 focuses on the identification and selection of appropriate indicators. The tables in Annex 1 provide menus of biological, socio-economic and management indicators from which a project-specific selection can be drawn. A key aspect of M&E is determining who is responsible for the tasks; institutional arrangements are discussed in Chapter 4. Finally Chapter 5 addresses the timing of preparation and implementation of M&E plans in the context of the Bank project cycle.

B. KEY CONCEPTS AND TERMINOLOGY

These guidelines deal with a range of concepts and terms which may need some clarification for those not familiar with biodiversity or project monitoring and evaluation.

Biodiversity

Biodiversity is an umbrella term encompassing all species of plants, animals, and micro-organisms, and the variation in ecosystems and ecological processes of which they are part. It is a multi-dimensional concept, difficult to define in an operational sense and difficult to measure.

Biodiversity Monitoring

Monitoring biodiversity is not as simple as monitoring other environmental characteristics, such as air or water quality for which there are well established standards or benchmarks. The biodiversity values of an area undergo considerable fluctuations as a result of natural processes. These natural variations need to be identified and monitored so that they can be taken into account in evaluating the results of project interventions. Moreover it is often difficult to assess the impact of project activities on biodiversity in the short term. Therefore monitoring must rely on indicators of likely success rather than absolute measurements of biodiversity.

Project Monitoring

Project monitoring is the collection of data prior to, and during, the project. These data, when analyzed, pinpoint progress or constraints as early as possible, allowing project managers to adjust project activities as needed. Monitoring is a continuing process throughout project implementation and often extends beyond project completion.

Measuring vs. Monitoring

There is an important difference between measuring biodiversity (e.g. number of species present) and monitoring changes in biodiversity. Measuring biodiversity provides a snapshot of biodiversity at the time of the measurement. It is useful for comparing relative biodiversity values of different areas (i.e. is one area more species-rich than another). Monitoring is measuring trends over time to determine whether management is having the desired result or needs to be changed.

Evaluation

Monitoring provides the basis for evaluation, which involves answering two questions: "has the activity met its objectives?" and "what accounts for its level of performance?" Evaluation tells managers whether they are moving toward, or away from, project or management goals, and why. It provides feedback to adjust future management interventions.

Indicators

Indicators can be quantitative or qualitative variables which can be measured or described and which, when observed periodically, demonstrate trends in biodiversity characteristics over time.

Baseline Studies

A baseline study describes the condition of target biodiversity prior to, or in the early stages of, project implementation. It is a benchmark against which management-induced changes can be identified and measured.

Preparation or commencement of a biodiversity' conservation project often requires a comprehensive survey to determine factors such as: the areas of highest biodiversity value; the types and location of threats to those values; the ecological history of the area, etc. However, future monitoring generally does not need to update this full data set. In most cases, managers are concerned with trends rather than absolute values. Absolute values (total number of species, exact densities, etc.) are generally not needed on a day-to-day basis; changes in relative indices of these parameters (trends) will provide the information that managers need. This is an important consideration, because too often there is a tendency to delay the commencement of biodiversity monitoring until baseline studies have been completed.

For many indicators, baseline data will be required to provide "calibration" of the indicators, and to show whether trends are moving dangerously close to unacceptable situations. However, these can be collected after monitoring has commenced, and will need to be repeated (usually at fairly long intervals) to "recalibrate" the indicators. Budgets for M&E plans should include funds for baseline and calibration studies; these can be relatively expensive undertakings.

Performance vs. Impact Indicators

Project monitoring and evaluation involves two kinds of indicators: *implementation performance indicators* (project inputs and outputs) and *project impact indicators* (achievement of objectives in relation to biodiversity).

Implementation performance indicators measure the progress in securing project inputs and delivering project outputs against set targets.

For biodiversity projects, special attention should be paid to timely execution of project interventions that address environmental degradation directly, *such as capacity building* for biodiversity management, and *project management* to oversee, coordinate and monitor the implementation of all project activities.

Project impact indicators reveal trends toward, or away from, biodiversity conservation. Such changes indicate whether the management needs to be modified so as to enhance or mitigate the effects of project interventions. As the main impact on biodiversity is human use, M&E plans for biodiversity should include both *environmental impact indicators* and socio-economic impact *indicators*.

These guidelines focus primarily on impact indicators for monitoring project effects on biodiversity values.

2 Formulating a Monitoring and Evaluation Plan

Biodiversity conservation projects are prepared primarily to conserve the biodiversity of selected sites, yet the long-term survival and viability of those sites, and the species populations within them, largely depends on social, economic and political factors which must be taken into account in project selection, design and implementation. Projects are designed on the assumption that project interventions will lead to conservation of key biological resources. Monitoring and evaluation are the primary vehicles to determine if biological diversity is being maintained as a result of project activities.

A. THE M&E PLAN

An M&E plan is a detailed program of work which sets out what monitoring activities will take place, when and by whom, and how that information will feed back into management decisions. The plan should include an estimate of costs of implementation, and identify training and capacity building needs for local staff and institutions responsible for monitoring identified indicators and implementing the M&E plan. Budgets should include the costs of equipment (including maintenance) and for training in their use. The plan should also describe mechanisms for feeding results back into the management process and indicate how the proposed activities will contribute to the establishment of a long-term monitoring and evaluation capability in the host country.

M&E plans should be developed as integral elements of all projects to provide information on whether project interventions are successful in achieving biodiversity objectives and on how social, economic, political and institutional factors are affecting project performance.

A biodiversity monitoring plan should, therefore:

- answer a clearly stated set of questions (i.e. have clear objectives);
- state clearly what indicators will be chosen;
- specify how often monitoring will be done and by whom;
- specify how often evaluations will be made and by whom;
- outline any necessary training that is required;
- state the intended audience for the evaluations;
- specify how information will feed back into management decisions;
- state clearly the decision points at which action must be taken to address negative trends; and
- specify costs and funding sources for the various activities.

In the developing country context it is especially important to develop an M&E plan that is simple, inexpensive, and sustainable.

B. SCOPING

A first step in project design is to clarify the objectives for biodiversity management, identify the sources of threat and determine how project activities can address them and with what consequences. A threats analysis links biodiversity and ecosystem elements with social factors, and analyzes direct and indirect causes of biodiversity loss. Specifying the relationships between threats and project activities designed to reduce them is an integral element of project design. Clearly identifying the

assumptions for project interventions will help to identify indicators for monitoring both changes in threats and the effectiveness of project interventions in mitigating those threats.

During project identification/preparation, an initial assessment is undertaken to compile an inventory of relevant existing information. This information should include (i) the environmental and socioeconomic conditions in the project area, (ii) the legal, policy, and regulatory framework governing the management of biodiversity, (iii) institutional responsibilities, organizational arrangements and existing resources available for biodiversity management, and (iv) inadequacies in the coverage and quality of the information base and institutional arrangements.

Scoping of the M&E plan should be done during project preparation. Experience has shown that there is seldom sufficient information available at this stage to prepare a detailed M&E plan. Nevertheless it is important to develop either the terms of reference for preparation of an M&E plan, or the preliminary outline of the M&E plan. This provides a basis both for the costing of M&E project components and for the development of the full M&E plan as soon as possible after project commencement.

Scoping of M&E requires the initial identification of:

- the extent and quality of existing knowledge of biodiversity values of the project area (including important gaps in that knowledge);
- the known significant biodiversity values of the project area;
- the nature of existing impacts on biodiversity;
- those aspects of biodiversity likely to be impacted (positively or negatively) by project activities;
- the nature of likely impacts of project activities on biodiversity (positive and negative, derived from project objectives and preliminary impact analysis);
- relevant existing M&E programs, including those at national and regional levels;
- the stakeholder groups who should be involved in the M&E activities and their ability to carry out monitoring tasks;
- types of training likely to be required to allow M&E to be carried out;
- the questions which will need to be answered by monitoring and evaluation.
- the geographical boundary of the monitoring activity;
- the time intervals for evaluation (for both performance evaluation and impact evaluation);

'Scoping may also include preliminary identification of suitable indicators, or at least classes of indicators, for particular aspects of biodiversity.

C. KEY CONSIDERATIONS

The following considerations need to be taken into account in formulating an M&E plan.

Temporal Scales

Because management of biodiversity deals with ecological processes which are generally long-term (e.g. changes in numbers in a population, or changes in community structures) the changes in biodiversity resulting from management interventions are also typically slow to emerge, commonly beyond project time frames. This suggests the need for the establishment of monitoring frameworks which will survive well beyond the project term. This is best done at the national rather than local level, not least because it will require ongoing policy and funding support. In addition, the long-term usefulness of any system of biodiversity monitoring and evaluation will be greatly increased if it is part of a national system of capacity building. It also enables national level evaluations as well as comparisons between different local areas.

Spatial Scales

Monitoring should be done at appropriate spatial scales to assess how the project is meeting ik biodiversity goals. Several factors will affect the spatial scale at which biodiversity can be monitored.

- Fragmentation of habitats at the regional or landscape level is one of the most pervasive threats to maintaining biodiversity. Many

protected areas are not sufficiently large to incorporate whole landscapes, and their boundaries seldom coincide with ecological boundaries. Monitoring biodiversity conservation often needs to extend beyond protected area boundaries to involve a regional scale of monitoring.

- Some types of threats or emerging trends in biodiversity health may be quite localized in their occurrence. This suggests a need to include monitoring at smaller scales, at least for some indicators.
- Biodiversity conservation is often most concerned with particular species or features in the environment. Monitoring for these should include some narrower, targeted measurements as well as broader-scale approaches.
- It is impossible to monitor all aspects of biodiversity at a site. In the interests of efficient use of human and financial resources, a monitoring plan should focus on key biodiversity elements that the project aims to conserve and the sources of threats to these elements. Key elements and indicator species will be defined by the objectives and focus of the project, e.g. medicinal plants, elephant populations, habitat or park integrity.

Taken together with the characteristics of biodiversity, these temporal and spatial factors suggest that biodiversity monitoring should be carried out at three scales: regional/landscape, community/ecosystem, and species/population. The emphasis will depend on the specific situation and project objectives but it will often be necessary to put some effort into monitoring at each level.

Socio-economics and Participation

Most threats to biodiversity result from human activities which, in turn, depend on social and economic factors. Monitoring of socio-economic factors, therefore, is an important part of biodiversity M&E. However, it is necessary to recognize that the relationships between biodiversity health and the socioeconomic characteristics of human groups causing impacts are far from clearly established. In fact they are likely to vary from one location to another. This needs to be taken into account in designing M&E plans, and particularly in identifying and interpreting socioeconomic indicators.

Biodiversity projects often have a wide range of stakeholders. Stakeholder groups should be identified by stakeholder analysis (see *Incorporating Social Assessment* and *Participation into Biodiversity Conservation Projects, 1994).* Groups which are likely either to impact on biodiversity health, or to benefit from biodiversity conservation, should be the focus of socio-economic monitoring.

There will sometimes be a connection between community participation in resource management and biodiversity health. This is not always necessarily beneficial to biodiversity conservation. Nevertheless, where communities have a good understanding of the need for biodiversity conservation and sustainable resource use, and see some benefit to themselves in these approaches, their involvement in resource management can make a significant contribution to the maintenance of biodiversity . It can, therefore, be useful to monitor aspects of community participation in biodiversity management.

Preparation of M&E plans and identification of relevant indicators should, as much as possible, involve those communities and institutions likely to be affected by project interventions (whether positively or negatively). This will be beneficial because:

- M&E is likely to be more sustainable if these players are involved;
- local communities often possess knowledge about ecological relationships and relationships between threats and effects that will contribute significantly to the identification of useful indicators and the accuracy of evaluation; and
- stakeholder involvement can contribute to the development of a sense of ownership of the resource management regime and responsibility for biodiversity health.

Institutional and Legal Factors

A range of institutional factors can have a bearing on biodiversity health. These include institutional capacity and coordination (capacity of government agencies, NGOs, local communities, etc. to undertake resource management and biodiversity maintenance); land tenure, property rights and customary practices; national policies and political will; ratification and implementation of international agreements, such as Ramsar and CITES, which include obligations for the signatory countries; and the existence and implementation of other appropriate legislation.

D. DATA COLLECTION, STORAGE AND PROCESSING

The identification of indicators and appropriate sampling regimes should take into account existing monitoring programs and data sets at the local and national level, capacity at these levels, and the need to establish agreed sampling and recording protocols at the national level. Consistency of monitoring approaches across local areas and protected area systems should have a high priority.

To the greatest extent possible biodiversity monitoring should make use of existing data sources in order to minimize costs. In addition, those responsible for the management of the area should be involved in the collection of biodiversity monitoring data as much as possible. Where it is necessary to bring in outside expertise to assist with monitoring, management staff should be involved in data collection, made familiar with the purpose and evaluation of the data, and trained to continue the monitoring plans.

There are many tools and techniques for biodiversity monitoring. h-t general methods should be chosen that are appropriate to the levels of human, financial and equipment resources available for the task. The advantages and constraints of some common monitoring tools are described in Box 1.

E. EVALUATION AND FEEDBACK INTO MANAGEMENT

Based on the results of the monitoring, an evaluation can be made of the effectiveness of project interventions in meeting biodiversity objectives, and any necessary revisions to project components can be identified and implemented. The effectiveness of project activities can be assessed in three ways:

- are they adequately addressing the direct and indirect causes of the threats to biodiversity?
- are they causing any unacceptable negative impacts on biodiversity values? and
- were activities adequately designed and implemented?

The results of evaluation of monitoring data can help to pinpoint where, and how, a project should be remodeled. Restructuring or redesign of project elements based on the results of M&E, will contribute to adaptive management, i.e. management which is responsive to changing conditions and project objectives.

The M&E plan should set out the time intervals (mid-term, terminal) between evaluations and should state who (individual, organization, or agency) will carry out evaluations and who will be the recipients of reports. For an evaluation to have some practical effect in improving conservation management, there should be specific mechanisms for feeding the results of evaluation back into the management process, and assigned responsibilities for follow-up.

As with monitoring, evaluation should be an ongoing part of biodiversity conservation management, rather than a project-based activity. Project preparation should include assessment of capability to undertake evaluation and, where necessary, capacity-building in evaluation techniques should be built into project design.

F. STEPS IN DEVELOPING AN M&E PLAN

Scoping of the M&E plan should be done during project preparation so that M&E needs can be identified and costed. At this stage, however, it is usually impossible to prepare a full M&E plan. There should be, therefore, sufficient flexibility within the project to allow further development and refinement of the M&E plan as necessary during project

BOX 1: Common Data Gathering Methods

Remote Sensing: Appropriate, regular and high quality remote sensing coverage, combined with Geographic Information System technology and ground surveys, can make an important contribution to biodiversity monitoring, especially of habitat integrity. However it needs to be recognized that in many countries resource management agencies will not be able to afford periodic acquisition of remote sensing data for monitoring purposes. It may be justifiable, however, to include acquisition of such data for establishing baseline conditions but future monitoring and training should not depend on access to regularly updated information where this cannot be supported by the management agency. Whenever possible conservation agencies should be encouraged to make use of remote sensing data sets acquired (and possibly already interpreted) for other purposes, possibly by other agencies.

Geographic Information Systems (GIS): Similarly, while GIS technology might appear essential for better data interpretation and producing more useful biodiversity monitoring results, its sustainability in the developing country context is often low, especially at the local area level. There are often compelling arguments for using more traditional data storage and presentation approaches (e.g. map overlay techniques) for biodiversity monitoring until adequate capacity (technical, financial and infrastructure) has been established to support GIS use. This provides an opportunity for those involved to learn and practise approaches which are not only extremely effective for many purposes but also provide a good grounding in the underlying theory of GIS.

Local Ecological Knowledge: Local community involvement is often an important element in management of protected areas and establishment of sustainable harvesting regimes for natural resources. Local villagers often have good knowledge of local biodiversity and changing conditions over time. Local ecological knowledge, therefore, can help determine appropriate indicators, refine sampling design, and interpret the results of monitoring. The data sets required for many biodiversity indicators can easily be collected by villagers, often with a minimum of training, and in a cost-effective manner.

Transect and Point Sampling: Transect and point sampling methods are commonly used for monitoring at the community/ecosystem and species/population levels. In particular, a number of population estimates and indices may be derived from a well-planned sampling program. The difficulties inherent in undertaking accurate and useful monitoring using these techniques, however, should not be overlooked. The key to success lies in careful planning and execution of the sampling. Transects or sampling areas should be as representative of the project area as possible, even if this seems inconvenient. Data collectors need to be trained to collect data in a standardized manner. All data collectors ideally should be able to collect information in the same manner, at the same rate, and with the same level of confidence.

Data collection protocols should be developed and occasional field checks should be carried out to ensure the quality of the data collection. A standardized data collection system or representative system of sampling transects should generate interpretable data for a long-term monitoring system.

implementation. Similarly it is generally more realistic at the scoping stage to identify classes of indicators rather than specific indicators, with the latter being refined and field tested during implementation. Chapter 5 illustrates how M&E fits with the Bank project cycle. Box 2 outlines the steps that a task team in China followed in order to develop an effective and operationally relevant M&E plan.

It is important to build incentives and capacity to collect, use and maintain data for monitoring and evaluation. However it needs to be appreciated that M&E will require additional work and budget. During the project these costs are included in the project budget. After the project it is likely that protected area, and other resource, managers will only focus on collecting

data that clearly assist in identifying or reducing threats or in raising awareness or funding. This is another good reason for focusing on indicators that are simple, relevant, easy to collect and can be incorporated into the normal duties of field staff.

BOX 2: M&E Plan For China Nature Reserves Management Project

The Nature Reserves Management Project in China initially proposed an M&E plan made up of 100-125 generic variables and indicators. The team quickly realized that monitoring all of those indicators was unrealistic and unnecessary. A first effort to prioritize indicators reduced the list to approximately 45. An additional exercise reduced the list to approximately 30 key impact indicators, focusing on improving the effectiveness of reserve management and field level protection; increased community participation and developing institutional capacity.

In doing the prioritization exercises, the project team agreed on certain principles for the M&E plan. These were:

- data should be simple to collect
- indicators should be practical
- M&E should guide adjustment to project direction
- the project M&E plan should be integrated into a long-term national M&E program in China
- it should provide lessons learned to the Government, Bank and GEF.

Based on those principles and using the following steps, the project team was able to develop an M&E plan that is based on project objectives and is dependent on the outcomes of the project. The basic steps were:

- state biodiversity project objectives
- identify inputs and outputs
- state expected outcomes, results and accomplishments
- state assumptions upon which the outcomes are based
- identify impacts expected as a result of outcomes or results
- identify how to measure results, outcomes, and impacts
- identify categories of indicators
- determine methods for collecting data (what, how, who, when), updating, analyzing and storing data

The task team, however, faced certain constraints when developing the M&E plan, and continues to overcome these constraints. These include:

- lack of funds (field work and data collection were not seen as priority uses for scarce budget resources)
- data collection was previously not seen as useful to nature reserve management
- staff were inadequately trained, and
- a lack of incentives for personel.

3 Identifying and Selecting Indicators

This chapter provides general guidance on identifying appropriate biodiversity M&E indicators. It is not possible to include an exhaustive list of the indicators of biodiversity health in a set of guidelines. Examples are provided in Annex 1 under a range of headings or menus to assist in the development of indicator sets relevant to particular situations. For most projects it will be appropriate to choose one or a few indicators from several sections.

A. KEY CONSIDERATIONS

In formulating a biodiversity M&E plan, the selection of indicators is determined largely by:

- the objectives for biodiversity management,
- the nature of the proposed interventions or activities,
- the feasibility and cost of collecting various types of information and data, and
- the institutional capability for incorporating them into analysis and decision making.

Most importantly, indicators must be practical and realistic, and should, whenever possible, be meaningful at both the national and site level, as well as consistent with the main objectives of the project (see Box 3). For example, monitoring changes in forest extent and integrity may provide useful information on park integrity, but will not provide information on the status of tigers or other wildlife if the main threat is poaching.

Box 3: Desirable Characteristics of Indicators

To be most useful and effective, monitoring indicators should:

- be cost-effective to monitor (maximum information with minimum sampling time, effort and expenditure),
- be measurable,
- reveal meaningful trends,
- point as directly as possible to the state of biodiversity in the subject area or the impact of a project activity on that biodiversity,
- be precise and unambiguous so that they can be clearly defined and understood the same way by different stakeholders,
- allow the identification of effects of "background" processes, such as weather, climate, catastrophic events, and natural variation,
- be selected to address the specific challenges of the individual project
- be amenable to sampling by non-specialists, including user/local communities (suggesting that the indicators should also be meaningful to local people),
- be consistent, i.e. continue to measure the same thing over time,
- be consistent with, if not the same as, national level indicators as well as those used in other protected areas, and
- require the involvement of the minimum possible number of individuals and agencies in their evaluation.

While it is desirable that the relationship between the indicators and biodiversity health is clear and well understood, this is seldom the case in reality. Often indicators must be selected intuitively, or on the basis of incomplete research. In all situations, one of the main purposes of indicators is to suggest emerging or real problems in biodiversity conservation so that management can be adapted to address the appropriate problems. It is realistic, therefore, to adopt an approach of using the best available knowledge to select appropriate indicators and to rely on a combination of indicators so that inconsistencies or inadequacies in any one indicator are balanced by evidence from others.

Biodiversity Value vs. Biodiversity Performance Indicators

There is a difference between measuring the biodiversity values of an area and monitoring the impact of management on biodiversity. While some of the indicators might be the same, many will be different. This distinction can have significant implications for conservation management. For example, the number (or percent) of species threatened with extinction or the number (or percent) of species with decreasing populations are sometimes cited as biodiversity indicators. As indicators of biodiversity value they may be useful for comparing different areas at the same point in time. However, using them as indicators of the impact of management on the biodiversity of an area could result in some unusual conclusions. For example, in an area which moves from having twenty percent of its species threatened with extinction to ten percent of species threatened, there are several possible scenarios: half the threatened species may have recovered; or, all the originally threatened species may be lost and ten percent of the remaining species may now be threatened.

Designers of biodiversity monitoring plans need to be aware of these distinctions and choose appropriate indicators.

Quantitative vs. Qualitative Indicators

In practice there are considerable difficulties in standardizing qualitative indicators so as to allow meaningful statements of changes over time. because recording or evaluating qualitative indicators frequently involves subjective assessment, it is generally better to avoid qualitative indicators for all but broad national or international level assessment of biodiversity conservation. However, in monitoring socio-economic factors it is frequently difficult to avoid the use of qualitative indicators. It may, however, be useful to combine qualitative data (e.g. focus group interviews) with quantitative data (from transect walks) to describe impacts and trends e.g. of levels of harvesting for specific plants.

Sometimes apparently quantitative indicators also harbor difficulties. For example, the existence of relevant legislation is frequently proposed as a biodiversity indicator. The situation would seem to be "no legislation" or "legislation exists." However, badly drafted legislation may be more detrimental to biodiversity conservation than no legislation at all. In addition, it is often difficult to determine why quantitative indicators have changed. For *instance, the change in the number* of *arres ts* for breach of the regulations seems as though it would be a useful indicator, but would the change (increase or decrease) be due to:

- more/less stringent policing?
- an increase/decrease in enforcement staff?
- an increase/ decrease in the number of breaches of the law?
- a change in the interpretation of the law?

B. IDENTIFYING SPECIFIC INDICATORS

A meaningful and operationally relevant biodiversity monitoring system will generally encompass a broad scope of levels and subjects to be monitored. These can be usefully categorized as:

- regional/ landscape level
- community/ecosystem level
- species/ population level
- socioeconomic factors
- community involvement and participation
- legal and regulatory factors, and
- management capacity and effectiveness.

Most projects will be monitoring several of these sets of indicators. Key indicators for M&E should be developed during preparation or early stages of project implementation. Particular attention needs to be paid to the way in which indicators are described. In most cases an indicator will be either a change in a parameter, or the *difference* between a measurement and an established benchmark for that parameter. For example, *catch* per unit *effort* (cpue) is not an indicator of overfishing - it is the change in cpue that is the indicator.

Classes of Indicators vs. Specific Indicators

In formulating M&E plans, there is a tendency to confuse classes of indicators with specific indicators. For example, *overfishing* represents a class of indicators-it cannot be measured directly. Indicators of overfishing include: change *in catch per unit effort, difference between largest size in catch and expected largest size for the species/population, and change in proportion of the species in catch.*

While it is useful to begin with classes of indicators, final M&E plans should include the specific indicators which will be used. It is only when specific indicators are stated that their feasibility and cost implications can be assessed. Examples of different categories of indicators are provided in Annex 1.

C. MONITORING AT THE REGIONAL/LANDSCAPE LEVEL

The important aspects of landscapes can generally be quantified in terms of area, diversity and pattern. Area measures such as "change in total area habitat" or "increase in area encroached" are often relatively easy to calculate providing the data are available. In addition, a range of indices has been developed which can be used to characterize the spatial arrangement of elements within landscapes. Table 1 (Annex 1) provides some examples of classes and specific indicators which might be used at this level.

D. MONITORING AT THE COMMUNITY/ECOSYSTEM LEVEL

At the community/ecosystem level, monitoring is concerned mainly with the effectiveness of maintaining extent and quality of habitat, and of maintaining ecosystem processes. because the maintenance of ecosystem processes directly affects the success of biodiversity conservation it is desirable that these processes should be monitored. However there are few simple, easily monitored indicators available for this task. Some species of plants and animals can be linked with ecological processes, e.g. keystone species such as major herbivores, top carnivores, important fruiting trees (such as fig trees), seed dispersers and pollinators for keystone tree species, and species which favor regenerating or disturbed environments. Changes in the number and distribution of well chosen examples of such species can sometimes be indicators of ecosystem processes. Table 2 (Annex 1) provides some examples of classes and specific indicators which might be used at this level.

E. MONITORING AT THE SPECIES/POPULATION LEVEL

Small population size is ultimately the most serious threat to species survival. Habitat destruction, overharvesting or overhunting can lead to local species extinction. Species monitoring is especially relevant to sustainable use projects. Low or decreasing population size is a significant indicator for important species, but demographic trends (population age and sex structure, age at reproduction) are usually more important than absolute population size. Detailed demographic studies of key or harvested species may need to be undertaken at regular intervals to confirm population viability, to calibrate population indicators, or provide information on sustainability of harvesting levels. The change in harvest per unit effort can be an indicator of the sustainability of the harvest, but it is difficult to quantify without the close cooperation of local people. The difficulty of sighting many species of wildlife means that secondary indicators such as signs of presence (e.g. tracks, scats, rubbing posts, etc.) or signs of removal (e.g.

butchered carcasses, used traps, poacher vehicle tracks, etc.) have to be used. Table 3 (Annex 1) provides some examples of classes and specific indicators which might be used at this level.

F. MONITORING SOCIO-ECONOMIC FACTORS

Socioeconomic indicators should relate directly to use or pressure on biological resources. In developing areas where the population is at an early stage of economic development, there will generally be connections between changes in wealth, either of whole communities or of sub-groups within the communities, and utilization of biodiversity resources. It would be unwise, however, to make assumptions about the direction of this relationship. Increasing wealth might imply less need for reliance on biological resources, or might be a result of increased harvesting responding to better access to markets.

Similarly, there are likely to be connections between changes in population and biodiversity health. In particular, rapid population growth is often associated with biodiversity loss. However, the raw data on human population change will often be less meaningful than information about changes in population characteristics such as age distribution, number in paid employment, education level, disposable income, time available for recreation, etc. The likely connections will need to be ascertained on a case-by-case basis and appropriate indicators included in the monitoring plan.

Some human activities which impact on biodiversity resources are not easily measured with any degree of accuracy and can only be estimated on the basis of indirect measures such as human population distribution or structure, or the presence of roads or other infrastructure.

In general, no reliance should be placed on a single socioeconomic indicator in isolation because of the general uncertainty of the relationship between this type of indicator and the state of biodiversity health. Table 4 (Annex 1) provides some examples of classes and specific indicators which might be used.

G. MONITORING COMMUNITY INVOLVEMENT AND PARTICIPATION

Community involvement in resource management is often an integral element of sustainable use. Monitoring community involvement will help to identify avenues for cooperation as well as training and capacity building needs. In addition, participatory management which has appropriate roles for local stakeholders can also make a contribution to maintaining biodiversity.

It is important to recognise that community involvement *per* se will not necessarily lead to enhanced biodiversity conservation. The nature and extent of community involvement that is appropriate will vary with site, community dependence on the resource and the biodiversity objectives of the project. The impact of community involvement in decision-making for management needs to be monitored closely to ensure that it is promoting biodiversity goals. Table 5 (Annex 1) provides some examples of classes and specific indicators which might be used to monitor community involvement

H. MONITORING INSTITUTIONAL AND REGULATORY FACTORS

Biodiversity conservation can only be achieved within a supportive legislative and regulatory framework. National legislation may be inconsistent, or executive orders contravene one another. National policy changes necessary for project success should be identified and indicators established to monitor progress. A range of factors will influence capacity to manage for biodiversity conservation. These include supportive and appropriate legislation and appropriate legal status for special areas; legal status and authority of management institutions; and appropriate policies on land tenure and resource use rights. Table 6 (Annex 1) provides examples of classes and specific indicators which might be used for legal and regulatory factors.

I. MONITORING MANAGEMENT CAPACITY AND EFFECTIVENESS

Biodiversity conservation is achieved directly through management activities which reduce pressure on biodiversity. The capability or capacity of the institution through which management operates, and effectiveness of the management which is carried out, will clearly affect biodiversity conservation. However, it is necessary to note that capacity for management is not always translated into effective management. Thus, two different sets of indicators are required - one set to measure capacity, and the other to measure effectiveness. Table 7 (Annex 1) provides examples of classes and specific indicators of management capacity and effectiveness.

4 Institutional Arrangements

A. GENERAL GUIDANCE

Project monitoring is the responsibility of the country management team or project implementation unit (PIU). The majority of the data for M&E is usually gathered by the local executing agency in the country of project execution. However, in certain complex or innovative projects, several agencies/departments may be involved. Thus, one overall agency must assume the overall responsibility and coordination. When there is a separate M&E unit, it should be integrated into the management structure of the implementing agency to best serve the information needs of the agency.

Institutional responsibilities for evaluations of project performance differ depending on the nature of the evaluation. For example:

Interim evaluations, designed to review progress and to anticipate likely effects of the project, are carried out during the project implementation period by the PIU.

Mid-term and terminal evaluations are carried out jointly at mid-term and at the end of the project by the government and the Bank, with the government and the PIU having particular inputs.

Impact evaluations, measuring direct and indirect project impacts, are normally undertaken several years after final disbursement by national authorities independent from the PIU, and/or the Bank (Operations Evaluation Department).

See Box 4 for an outline of the responsibilities of major players in the M&E process.

B. DISSEMINATION OF INFORMATION

Information gathered through M&E is useful to a number of different audiences (nationally, regionally or globally), and for dissemination of lessons learned and development of good practice. M&E allows the assessment of project achievements and impacts and provides useful input to the target project as well as lessons learned for influencing design of future projects.

C. COORDINATION WITH NATIONAL M&E COMPONENTS

The performance monitoring of biodiversity projects should be done at the national level by the sectoral agencies responsible for such areas as parks, protected areas and wildlife (habitat and species protection), fisheries (management of fishing effort and production), wetlands (restoration), agriculture (land use), forestry (afforestation of watersheds), and ex-situ (gene banks) or systematic collections (museum, herbarium), etc. The design and implementation capacity of many existing sectoral monitoring programs is weak and will frequently need strengthening. The PIU, working with national agencies, should be responsible for procuring the equipment and support required for monitoring. Most importantly, it should implement the human resource development plan (individual training, workshops, study tours, etc.) to enhance M&E skills throughout the agencies involved.

Box 4: Responsibilities of Major Players in M&E

Level	Responsibility
Local Executing Agency(ies)/ PIU	• Coordination of monitoring activities . Coordinating training in collection and analysis of monitoring data for data collectors . M&E data collection and analysis . Maintenance of information management system, including all existing information and baseline data · Periodic progress reports · Implementation of modifications as necessary
Overall Executing Agency (if different from local executing agency)	. Coordination of M&E if more than one local executing agency . Preparation of semi-annual, annual, mid-term and final reports . Collaboration with other biodiversity projects . Supervision of M&E personnel including recruitment and training · Statement of expenditures · Disbursement records · Procurement records · Financial and technical audits · Ensuring feedback into project management . Dissemination of information and lessons learned to all other interest groups, both local and global
World Bank	. Supervision of project . Informal advisor to Local Executing Agency/ PIU . Verify disbursement/procurement . Confirm accuracy and adequacy of reporting mechanisms

D. REGIONAL COORDINATION OF NATIONAL M&E COMPONENTS

Biodiversity conservation projects often address the transboundary aspects of protecting landscapes and ecosystems. Transboundary solutions require coordination of national M&E plans under the umbrella of intergovernmental or regional cooperation to ensure sound environmental management. This coordination reinforces the sharing of M&E objectives and targets, so that national M&E plans are synchronised and complementary, and ensures that methods for collecting, analysing, and reporting data in the participating countries are compatible.

5 M&E and the Bank Project Cycle

Monitoring and evaluation needs to be an inherent part of every component of a project. Moreover, M&E needs to commence as early in the project implementation phase as possible. Experience has shown that this has often been difficult to achieve, generally because little attention has been paid to the details of M&E during pre-implementation phases. M&E needs to be addressed at each stage of the project cycle: identification/preparation; appraisal/ negotiation; and implementation/supervision.

A. IDENTIFICATION AND PREPARATION PHASE

During both the identification and preparation of the project, the task team and the country project preparation team should ensure that the following M&E related tasks are completed.

1. Include the identification of indicators for monitoring and evaluation in the terms of reference of all key members of the preparation team (e.g. biodiversity specialist, sociologist, legal/ institutional specialist).

2. Early in preparation, compile an inventory of all existing information. This inventory should focus on obtaining information on:

- biodiversity of the project area, and threats to biodiversity
- socio-economic conditions of populations living in and around the project area, especially those dependent on, or impacting on, biodiversity
- community management of natural resources and opportunities for participation
- institutional responsibilities and capacity for biodiversity management and conservation
- legal, policy and regulatory framework governing management of biodiversity

3. Clarify the questions to be answered by the M&E plan on the basis of a clear understanding of the biodiversity in the project areas and the project goals, taking into consideration:

- availability of human and financial resources
- availability and knowledge of technologies
- degree of understanding of the issues to be considered

4. Propose specific indicators or classes of indicators to provide a continuous and long-term assessment of changes or trends that show or suggest alteration of biodiversity in the project area.

5. Propose process indicators to monitor whether the project has met its performance objectives (inputs and outputs).

6. Identify a management information system to support monitoring and evaluation, according to proposed indicators to cover:

- data collection, including methods
- analytical methods for data evaluation
- information dissemination/ sharing
- equipment and technology

7. Propose institutional responsibilities and organizational arrangements for monitoring and evaluation to cover:

- management of data
- technical skills, training and labor requirements
- coordination between national agencies

8. Estimate the costs of implementing the M&E plan. Note that monitoring and evaluation should not be an additional cost to the regular activities carried out in the project. Rather M&E activities should be built into project activities. There may be additional costs, however, for reporting and dissemination of information and, in certain cases, training. Costs and funding sources should be identified.

9. Prepare a time-bound implementation schedule with assigned responsibilities for the implementation of activities.

B. APPRAISAL AND NEGOTIATIONS PHASE

During appraisal and negotiations, task teams and executing government agencies should address the following priorities in respect to monitoring and evaluation.

1. Assess the adequacy of the proposed M&E plan (or terms of reference for M&E plan, depending on the outcome of the scoping activity) in relation to:

- responsiveness to project objectives
- technical feasibility
- institutional capacity and human resources needs
- stakeholder and NGO involvement in design and implementation
- adequacy of proposed mechanisms for regional coordination
- mechanisms for feedback and dissemination of lessons learned
- cost effectiveness
- budgetary commitments by participating country governmenk
- sustainability

2. Negotiate Grant Agreement assuring that the legal agreement includes target variables and indicators, target dates, standards for monitoring and evaluation, and reporting responsibilities.

C. IMPLEMENTATION PHASE

Monitoring and evaluation of biodiversity need to commence as soon as possible during the implementation stage. In many situations there will be a need to fill gaps in knowledge identified during scoping and to further identify indicators which are appropriate to local conditions. Training and equipment may need to be delivered before the M&E plan can be fully implemented.

Apart from supporting the further development and implementation of the M&E plan, country agencies/ departments responsible for M&E and task teams responsible for project supervision will need to address the following priorities.

1. As monitoring data become available (target dates agreed upon at negotiations), undertake periodic evaluation of project performance relative to stated objectives. These evaluations should attempt to:

- determine if the objectives for addressing threats to biodiversity are being achieved by the project,
- evaluate any ancillary benefits achieved by the project, and
- assess the technical and/or institutional reasons why anticipated targets were either met, missed or exceeded.

2. Assess and improve the relevance and effectiveness of the M&E plan by:

- validating the relationship between indicators and objectives for biodiversity protection,
- verifying the rapidity, quality and quantity of information transfer within the information system,
- reviewing the extent to which implementation of the M&E plan has facilitated project management, and
- providing feedback to project executank so that management can be adapted to better serve conservation objectives.

Annex 1 Sample Indicators

Table 1: Examples of Indicators at the Regional/Landscape Level

Class[1]	Indicator[2]	Data Set	Method	Comments
Habitat area	Change in total area of a particular habitat type	Remote sensing data (vegetation maps may already exist for baseline)	Manual methods using overlay maps, or GIS where feasible. Aerial surveys	Shows whether habitat is being gained or lost over the monitoring area. Ideally the monitoring area should extend outside the immediate project area. Comparison between the project/no-project areas may be useful.
	Change in area of largest block of a particular habitat type			Long-term population viability is endangered if area is small! especially for species which occur at low density.
	Change in average size of a particular habitat type.			Suggests whether losses are spread over the whole monitoring area.
Landscape pattern analysis	Change in mean nearest distance between blocks of a particular habitat type	Remote sensing data or measured in the field		Suggests likelihood of migration between habitat blocks. Can be modified to mean distance between a particular block and neighbors where the particular block is in a protected area (PA). More complex approaches to landscape pattern analysis may be appropriate in some circumstances.
	Change in average width of break in an identified habitat corridor			Shows changes in effectiveness of the corridor. Changes in the gap width should be a trigger for management attention. However significance depends on the species of concern and the type of land use in the gap.
Conservation status	Change in number or total area of PAs	Spatial plans	GIS or overlay maps	Shows change in conservation status (and therefore likelihood of protection) of land/habitat.
Land use type	Change in total area of land uses compatible with biodiversity conservation in the monitoring area	Area of identified compatible land uses	Remote sensing data or field reports. Land use maps are likely to be available from other agencies.	Shows change in area likely to support biodiversity conservation - significance may depend on the focus of biodiversity value in the area.

[1] These are examples of appropriate classes. Others can be developed.

[2] These are examples of appropriate indicators. Others can be developed.

Table 2: Examples of Indicators at the Community/Ecosystem Level

Class	Indicator	Data Set	Method	Comments
Vegetation structure	Change in crown cover percent	Canopy cover in % at upper canopy level (whether tree, shrub, grass, etc.)	Standard canopy cover methods, possibly done seasonally, or at least annually in the same season	Significant habitat disturbance is generally indicated by changes in canopy cover and dominant species. However, records need to be long term to take into account short-term fluctuations due to factors such as tire and weather patterns. Not likely to provide early warning of changes which are not revealed by other, possibly easier, methods.
Habitat distribution	Change in location of habitat boundaries	Location of boundary in defined quadrats or transects[3]	Long-term (possibly every two to five years) survey of sites, and/or fixed point photography	Can show expansion or retreat of crucial habitats. Changes may take many years to establish and generally background effects need to be removed.
	Change in vegetation along watercourses	Area of riparian vegetation type. Boundary of riparian vegetation, etc.	Remote sensing or transect, quadrat survey	Changes in riparian vegetation can have significant effects on aquatic biodiversity through direct (change in water temperature and light availability) and indirect (increased run-off, siltation, etc.) impacts.
Keystone or indicator species	Change in number and/or distribution of keystone or indicator species	Transect or wide area survey results	Survey of transects or sites, frequency depends on the species involved	Can suggest changes in ecological processes, particularly to provide early warning of possible changes. Examples include species important in seed distribution (certain birds, rats, etc.), bat species favoring different vegetation structure.
	Change in limiting factors for key species, e.g. nest holes for parrots, fruit bat roosting trees	Numbers, or presence or absence - depends on the factor involved	Transects, quadrats, general observations.	Can provide early warning of impacts on species before changes in numbers become obvious.
nvasive species	Change in presence, location, area, numbers of invasive plant or animal species	Survey, transect or quadrat results, patrol reports, reports from community members	Transects, quadrats or interviews	The significance of the invasive species for the biodiversity values which are of concern needs to be known. In many cases plant invasions are an indicator of disturbance. Dieback (*Phythophthora* fungus) may also be an indicator of disturbance.
ndicator events	Changes in frequency of events such as landslips	Patrol reports, aerial surveys, remote sensing	Incorporate into patrol reporting. Carry out specific surveys for identified events.	Events should be of a type which is related to biodiversity health at the community/ecosystem level.

[3] Transects may be more reliable than quadrats (plots) because of the possibility that marked quadrats will receive special management attention. The same transects mieht be useful for faunal surveys.

Table 3: Examples of Indicators at the Species/Population Level

Class	Indicator	Data Set	Method	Comments
Abundance	Change in abundance of key animal species	Encounter rate (e.g. sight, sound, sign) along transects. Number of individuals at concentration points such as colonies or roosts. Management patrol reports.	Management staff monitor transects (e.g. sections of track) on regular patrols. Regular counts at concentration points.	Indicates possible changes in population size and/or shift in range (interpretation should be subject to knowledge of demography and comparison with other indicators). Needs to be standardized (e.g. by time/distance/habitat). More rigorous methods must be used occasionally to calibrate encounter rate against total population.
	Change in proportion of particular species in fish catches at specified seasons	Records kept by community	Management staff collect information from community	Can show changes due to environmental factors, overharvesting, and/or introduction of exotics.
Stock management parameters	Difference between largest/longest of a given species in fish catch and largest/longest recorded size for the species.	Average sizes/lengths of fish of given species in catches. Maximum sizes from literature.	Some community members paid to collect data, or fish marketing staff collect data.	This is one example of a fisheries management approach. Others may be appropriate in particular situations.
Range occupied	Changes in range of designated species (either total range or range within monitoring area)	Combination of sighting data and transect sign data	National level staff combine indicator data for all relevant areas.	Indicates expansion or reduction of species range. Could be associated with population changes, loss of habitat or disruption of migratory pathways.
Hunting/harvest changes	Change in total amount of plant or animal species harvested in a defined site eg. PA	Amount of resource harvested in a defined area as recorded by the local community	Record keeping by community or a sub-group	Trends in amount harvested should give early warning of over-harvesting, especially when combined with the following indicator.
	Changes in amount of designated resource harvested per unit effort	Amount of resource harvested per unit effort[4]	Community, sub-group of community, or nominated individuals keen records.	Changes in harvest per unit effort can indicate developing over-harvesting situations.
	Changes in number of confirmed instances of hunting and/or harvesting of designated species in a given time period	Combination of: field evidence and village and market surveys.	Information collected by management patrols, from villagers or from market traders.	An increase may indicate a developing management problem. A decrease should be interpreted only in conjunction with other information.

[4] A "unit effort" might be person-days, or hours spent collecting, or total number of overnight stays in the area. The unit effort needs to be meaningful to the monitoring community.

Table 4: Examples of Socio-Economic Indicators

Class	Indicator	Data Set	Method	Comments
Human population dynamics	Change in total human population inside and around (e.g. within 20 km) conservation areas	National or local statistical data or survey returns Data from baseline and repeated socio-economic surveys	Formal census data obtained from relevant agency. Surveys, possibly involving sampling. Monitor every 2-5 years.	Rapid growth likely to indicate negative impacts on biodiversity. In addition, any increase inside PA might suggest illegal incursion. Interpret in combination with next indicator.
	Change in demographic factors (age structure, settlement patterns, education levels, etc.) of relevant human population in or around conservation areas			Indicates possible changes in level and nature of pressure on biodiversity values. Relationships are neither constant nor well understood. For example, increasing level of education may correlate with reduced interest in a subsistence lifestyle; or increasing time available for recreation may lead to recreational hunting. May be more useful for assisting in the interpretation of other indicators than as an indicator of biodiversity health itself. Careful analysis is required.
Socio-economic situation	Change in proportion of income derived from biodiversity resources	Survey returns	Participatory techniques (RRA, PRA, etc.) and other socio-economic survey techniques, possibly every two or three years	While reliable income data is notoriously difficult to gather, data on proportional importance of different sources, without requiring specific figures, is easier to collect.
	Change in proportion of income derived from alternative livelihood activities			Requires training of survey personnel, and the relatively low frequency of survey may mean that it is more effective to use outside, specialist teams.
Resource utilization	Change in resource consumption for household use vs. marketing	Survey returns, management records, market surveys	Participatory techniques (RRA, PRA, etc.) and other socio-economic survey techniques, possibly every two or three years	Relatively standard survey techniques exist for this.

Table 4: Examples of Socio-Economic Indicators				
Class	**Indicator**	**Data Set**	**Method**	**Comments**
Resource utilization	Change in rate of consumption of biodiversity resources by different groups (e.g. local communities vs. outside interests)	Survey returns, management records, market surveys	Participatory techniques (RRA, PRA, etc.) and other socio-economic survey techniques, possibly every two or three years	May show which groups are increasing or reducing their resource use, suggesting whether project initiatives have been successful (or are appropriately targeted). Provides a check that reduction in resource use by the target group is not part of an overall reduction unrelated to project initiatives.
	Change in number or percent of people harvesting biodiversity resources			May have a direct bearing on biodiversity health. Lower numbers, combined with other socio-economic data, may give a clear indication of likely future trends in involvement in biodiversity-impacting activities.
	Change in levels of exploitation toward or away from sustainable use			
41temative livelihood uptake	Change in number or percent of people engaging in alternative livelihood activities	Survey returns, management records, market surveys	Participatory techniques (RRA, PRA, etc.) and other socio-economic survey techniques, possibly every two or three years	Participation data may be relatively easy to gather because of the need to register for assistance, loans, supplies, etc. May have a direct bearing on biodiversity health if this group has also given up biodiversity-impacting livelihood activities, though this should not be taken for granted.

Table 5: Examples of Community Involvement and Participation Indicators

Class	Indicator	Data Set	Method	Comments
Attitudes and understanding	Change in understanding/ acknowledgment of co-management principles by government agency staff	Results of structured interviews and questionnaires	Structured interviews, questionnaires	Participation indicators rely on the assumption that participatory management will make a positive contribution to biodiversity conservation.
	Extent to which community feels involved in management at different levels (e.g. decision-making, consultation, etc.)			Without these factors, participation will not be sustainable in the long term.
	Extent to which community understands and agrees with management approaches			Lack of agreement with management approaches suggests low likelihood of cooperation and/or low understanding of basis for management. Both will detract from effectiveness of biodiversity conservation.
Existing resource use systems	Existence of community-based natural resource management systems	Structured interviews	Structured interviews	If a system exists then a better indicator would be the effectiveness of that system (see next table).
Biodiversity conservation benefits	Increase in cash or in-kind benefits returned to community as a result of biodiversity conservation	Project records, alternative income scheme accounts, survey results	Review relevant records, carry out interviews	Assumes that these benefits will lead to a reduction in biodiversity impacts.

Table 5: Examples of Community Involvement and Participation Indicators				
Class	**Indicator**	**Data Set**	**Method**	**Comments**
Biodiversity conservation benefits (cont'd)	Change in number and/or nature (full time, seasonal, etc.) of community members employed in project and related activities	Project reports, project employment records.	Examine reports and records every one or two years.	Employment of local people on project activities has a range of potential benefits which may act to reduce biodiversity impacts. For example: immediate improvement in income and/or standard of living; training which improves long-term employment options; training in organizational skills which are relevant to community development; increased awareness of project objectives and background.
Conservation awareness and education	Number of awareness programs undertaken	Project reports	Annual surveys	Indicates community interest in and commitment to sustainable resource use/conservation activities.
	Number of schools visited			
Participation in management.	Change in community cooperation with conservation staff (such as anti-poaching activities, monitoring)	Results of interviews and PRA with communities and government agency staff.	Interviews and PRA	Cooperation suggests commitment to meeting management objectives, including biodiversity conservation.
	Self-monitoring of resource by users			May depend on "traditional" natural resource management system in place.
	Establishment of clearly defmed boundaries and membership of resource using group	Project records, local rules, regulations	Review records, rules and regulations (annually or less frequently)	These are criteria for establishment of a successful participatory resource management system. Indicators might be framed as changes in the effectiveness of these factors.
	Existence of representative coordinating or management body	Management records	Annual surveys of communities and conservation staff, local records, interviews	This could have positive or negative effects on biodiversity. Should be analyzed as a long-term trend. Monitored at specific intervals rather than on an on-going basis.

Table 6: Examples of Legal and Regulatory Indicators				
Class	**Indicators**	**Data Set**	**Method**	**Comments**
Status of appropriate legislation and policies	Change in the legal and regulatory framework at the national level	Official gazette, national law registry	Review of status of existing and pending legislation and policies, including legislation on protected areas and endangered species	Changes can indicate positive or negative effects on biodiversity health. The enactment of a poorly drafted law or lack of enforcement of an appropriate law can have significant negative impact on biodiversity. Monitoring of this indicator needs to include some assessment of the quality, appropriateness and enforcement of the changes to the laws.
Legal status of protected area	Change in the legal status of an area (e.g. legal gazettement), including defmition of boundaries		Review status of boundary demarcation.	Changes can be positive or negative. For example, an area with high and sensitive wildlife values may suffer reduction in biodiversity value as a result of declaration as a national park rather than a strict wildlife reserve.
Status and sustainability of management bodies	Change in permanent institutional arrangements and/or management structure	Structural organization of management	Evaluate incorporation of project management units into permanent structures, co-management arrangements, decentralization of management	Management structures may exist at the national, regional, local and site levels. Monitoring may be separate or combined, depending on the project objectives.
Policy on use rights	Change in use rights at a project site	Government policies and laws on use rights	Track the development and implementation of policies and laws which define user rights in an area.	Are use rights not only recognized but also appropriately allocated in a way which supports any traditional management system and which will encourage sustainable management?

Table 6: Examples of Legal and Regulatory Indicators

Class	Indicators	Data Set	Method	Comments
Understanding and/or awareness of legislative controls	Change in local level or resource user/regulator awareness of the important components of relevant resource management laws and regulations	Survey and interview data	Surveys and interviews	Unless key groups are aware of the important components of the laws, the law will have no effect. Voluntary adherence is preferable to reliance on enforcement alone.
Effectiveness of regulatory system	Change in level of infringements	Evidence of infringements (physical evidence in field, community reports, official records)	Establish agreed acceptable level and calculate the difference annually, or at an interval agreed with stakeholders.	Zero infringements is generally not a realistic or necessary target. In most situations some level of infringements is tolerable. The difference between this and the actual level of infringements provides an indication of the effectiveness of the regulatory system.
	Change in percentage of arrests leading to conviction	Field and official/ court reports	Calculate from field and official/court reports	"Number of arrests" is not a useful indicator as there are too many factors which may affect it. If arrests are well founded and properly carried out (legal requirements followed, evidence properly gathered, etc.) then convictions are likely to result.
	Change in percent of repeat offenders appearing in court			If the regulatory system is efficient and well designed (e.g. penalties match offenses and socio-economic conditions) then the percentage of repeat offenders should decrease.

Table 7: Examples of Management Capacity and Effectiveness Indicators5

Class	Indicators	Data Set	Method	Comments
Budget/funding	Change in proportion of budget allocated to highest priority conservation management areas/functions	Budget documents	Identify highest priorities and review budget allocation annually.	Project implementation (or design) should have identified the highest priorities. This indicator may not be effective during project implementation because of substitution of project funds for normal budget allocations.
	Change in sustainability of funding for management	Information on (proposed or actual) management funding sources.	Review information annually or less often.	This indicator may not be effective during project implementation because of substitution of project funds for normal budget allocations.
	Change in availability and timeliness of release of funds	Annual budget. Local financial records. Results of interviews with local management staff.	Calculate from official records and interview results.	This can be a hidden factor paralyzing an otherwise apparently well established and potentially effective biodiversity conservation system.
	Change in extent to which field and local management staff are involved in, and understand, the budgetary process	Results of interviews with local management staff.	Interviews with local management staff	Unless local management staff have a meaningful role in the preparation and allocation of budgets, funds may not be directed to the most important issues.
Facilities and equipment.	Change in quality and/or quantity of facilities and equipment	Management records, inventory.	Identify the equipment and facilities needed, and available.	Include vehicles, boats, aircraft, field equipment, survey equipment, data recording and storage equipment.
Staffing	Change in the number of trained staff in relevant agencies or areas (needed vs. actual)	Staffing levels	Calculate necessary staffing levels and check actual staffing levels annually.	Needs to be combined with other indicators such as performance ratings, time in the field, etc.
Staff performance	Change in the rate of turnover of staff at a site	Staff records	Calculate from official records	Rapid turnover is clearly likely to reduce the effectiveness of biodiversity protection.

[5] Capacity and effectiveness of management are not the same. An organization may have a high level of capacity to manage but its effectiveness may be hindered due to a range of factors.

Table 7: Examples of Management Capacity and Effectiveness Indicators

Class	Indicators	Data Set	Method	Comments
Staff performance (cont'd)	Change in average performance rating of staff at a particular location	Results of individual performance evaluations (duty statements; training history; work programs; field patrol records), interview results	Develop and use a performance rating system, and update ratings every 1-2 years.	Training is not an indicator of effective performance. It is the way skills and knowledge gained through training are translated into improved performance and changed behavior that shows effectiveness. Performance rating systems take time to design, require a basis of duty statements and capability criteria for designated positions, and should be developed and implemented in a participatory manner.
	Change in the (average) amount of time (person-days) spent in the field	Time sheets and field reports	Calculate field time.	It may be more indicative to use an average of field days per management staff member, so that efforts by one or two staff, or special projects, do not skew the results.
Management structures and arrangements.	Existence of representative coordinating or management body which involves key stakeholders	Project/government records, community interviews.	Examine records or conduct interviews.	In addition to being effectively representative, such a structure should make/improve links between field level and development decision-making levels. An additional indicator is the change in the effectiveness of such structures.
	Existence of formal conservation agreements			An additional indicator is the change in the effectiveness of such agreements.
Awareness levels	Change in level of understanding of biodiversity concepts and conservation objectives	Results of structured interviews/ questionnaires	Structured interviews and/or questionnaires	Specific target groups should be monitored separately, e.g. field management staff, resource user groups, local government officials.
Ongoing monitoring capability	Change in budget allocated to monitoring, or number of staff trained in monitoring	Results of review of budget, staffing, management systems	Review budget, staffing and management systems annually or less frequently.	If there is no ongoing monitoring capability then the sustainability of biodiversity conservation is at risk. The capacity to monitor must exist before effective monitoring can occur.
	Status of monitoring information management system	Management systems	Review of existing systems	

Table 7: Examples of Management Capacity and Effectiveness Indicators

Class	Indicators	Data Set	Method	Comments
Ongoing monitoring capability (cont'd)	Change in integration of biodiversity monitoring into the routine duties of field staff.	Annual work programs and patrol reports	Review annual work programs and patrol reports.	Acceptance of biodiversity monitoring as a normal part of management activities suggests that it will be sustainable.
Effectiveness of management bodies	Change in extent and timeliness of implementation of scheduled/planned activities	Management records	Calculate whether management bodies are meeting agreed targets	Failure to implement planned biodiversity conservation activities on time or as planned could lead to biodiversity loss in the long term.
Threat levels.	Change in number and nature of threats to site	Recorded evidence of unlawful activity, field reports and aerial surveys, results of threat review, new development plans.	Calculate from official reports. Carry out threat review.	This applies to resource conflict, hunting, tire damage, forest clearing, poaching, etc. Requires a ranking of the threats to determine whether a change in nature of threat is a positive or negative trend. Effectiveness will be minimal unless there are clear guidelines as to what constitutes a threat and how much effort needs to be expended in identifying threats. A fairly gross indicator at best.
Encroachment	Change in rate of encroachment into PAs	Remote sensing data, field reports, land use data.	Remote sensing, aerial surveys, map overlays, GIS should be repeated every two to five years.	Shows direct impacts on biodiversity health. Easy to analyze, though data gathering may be difficult, depending on resources and capabilty.
Conflict resolution	Existence of an agreed procedure for conflict resolution on natural resource management issues	Project or government records, documentation of traditional resource management regime.	Review records and documents, interviews	If a conflict resolution mechanism already exists, then a better indicator would be the effectiveness of that mechanism
	Change in proportion of conflicts which are successfully resolved	Project and government agency records, interview results, PRA results.	Review records, carry out interviews and PRA.	Successful resolution may depend on the point of view of the party involved. As a minimum all parties should agree that the solution is according to the established rules.
	Reduced conflicts over access or use rights			
	Change in tolerance of wildlife on community land	Community and management records		Can indicate acceptance of conservation objectives; usually linked to benefits accruing to communities.

Bibliography

Chisholm, A. H. and Dumsday,R. G. (1995). Environmental Indicators and Land Resources Policy: An Australian Perspective, *In Developing Indicators for Environmental Sustainability: the Nuts and Bolts,* edited by Sandra S. Batie. . Proceedings of the Resource Policy Consortium Symposium, Washington, D.C.

Dixon, J., Kunte, A., and Pagiola, *S., (1996). Environmental Performance Indicators.* World Bank Environment **Department Note.** Washington, D.C.

Global Environment Facility. *(1996). Operational Strategy.* Washington, D.C..

Hammond, A., Adriaanse, A., Rodenburg, E., Bryant, D. and Woodward, R. *(1995). Environmental Indicators: A Systematic Approach to Measuring and Reporting on Environmental Policy Performance in the Context of Sustainable Development.* World Resources Institute, Washington, D.C.

MacKinnon, J.,MacKinnon, K., Child, *G.* and Thorsell, J. (1986). *Managing Protected Areas in fhe Tropics.* IUCN. Cambridge.

McNeely, J.A., Miller, K.R.,Reid, W.V., Mittermeier, R.A. and Wemer,T.B. (1990). *Conserving the World's Biological Diversity.* IUCN, Gland, Switzerland; WRI, CI, WWF-US, World Bank, Washington, D.C.

Margoulis, R. and Salafsky, N. (1998). Measures *of Success:* Designing, Managing and Monitoring Conservation *and DevelopmentProjects.* Island Press, Washington, DC.

Operations Evaluation Department (OED) *(1996). Lessons and Practices. Designing Project Monitoring and Evaluation.* World Bank.

Ostrom, E. (1991). *Governing the Commons: The Evolution of Institutions for Collective Action.* Cambridge University Press, Cambridge.

Peters, *C. (1994). Sustainable Harvest of Non-Timber Plant Resources in Tropical Moist Forest: An Ecological Primer.* Biodiversity Support Program, Washington.

Reid, W., McNeely, J., Tunstall, D., Bryant, D. and Winograd, M. V. (1993). *Biodiversity Indicators for* Policy *Makers,* World Resources Institute, Washington, D.C.

Saunders, D., Margules, *C.* and *Hill,* B. (1998). *Environmental Indicators: Biodiversify. Australia: State of the Environment Indicator* Report. Environment Australia, Canberra

United Nations Environment Programme. (1995). *Global Biodiversity Assessment.* Cambridge University Press, Cambridge.

World Bank. *(1992). Guidelines for Monitoring and Evaluation of GEF Biodiversify Projects.* Washington, D.C.

World Bank. *(1994). Incorporating Social Assessment and Participation into Biodiversify Conservation Projects.* Washington, D.C.

World Bank. (1996). *Guidelines for Using Social Assessment to Support Public Involvement in World Bank-GEF Projects.* Washington. D.C.

World Bank. (1996). *Performance monitoring indicators: A handbookfor task managers.* Washington, D.C.