Accessing and monitoring of biodiversity

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Abstract

Assessment of diversity of Albanian National Inventory is carried out using import statistics by passport descriptors from Plant Genetic Resources database. Flora of Albania identified more than 3250 species of plants, but only 2% of them are included in the National Inventory of Albania in EURISCO catalogue. Albanian National Inventory of Plant Genetic Resources in EURISCO (2% of Albanian Flora) includes 33 genera, 62 species and 2111 accession, where 54% of them are collected genetic materials. Target population: entire set of sampling units to which findings of the survey are to be extrapolated. 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 monitor and evaluate plans for biodiversity conservation 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: implementation performance indicators and project impact on biodiversity. These guidelines focus primarily on the latter . Monitor and evaluate plan is a detailed program of work which defines what monitoring activities, 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 monitor and evaluate. In the developing country context it is especially important to develop a monitor and evaluate plan that is simple, inexpensive, and sustainable in terms of the financial, institutional, and technical resources available

Keywords: Accessing, biodiversity, ecosystem, monitoring

Introduction

Biodiversity include fundamental things to our health like fresh water clean air and food products, as well as the many other products such as timber and fiber. Biodiversity also includes various other important things and services such as cultural, recreational, and spiritual nourishment that play an important role in maintaining our personal life as well as social life(Wanjui *et al.*, 2019). Monitoring animal populations is central to wildlife and fisheries management, and the use of N-mixture models toward these efforts has markedly increased in recent years. Nevertheless, relatively little work has evaluated estimator performance when basic assumptions are violated (Duarte *et al.*, 2018). It was assessed whether opportunistic citizen science databases are viable data sources to model species distributions and test if species attributes can indicate the reliability and completeness of the opportunistic distribution data.(Tiago *et al.*, 2017).Conservation biologists have drawn up a range of guidelines for the conservation of genetic diversity—to maximize the chances that populations of threatened species persist, and to conserve this variation for its potential utility*(Whitlock, et al.*,2016).

Coral reef ecosystem is the most threatened ecosystem among marine ecosystem in the world due to the combination of anthropogenic and natural disturbances. More research is needed to be monitored and assess coral reef ecosystems, which will be used to find understanding of the ecological integrity and further improvement of the protection strategy in the future (Muchtaromah, 2013). National Parks are a cornerstone for biodiversity conservation in Africa. Two approaches are commonly used to sustain biodiversity in National Parks. Past and current studies show that both approaches are generally ineffective in conserving biodiversity in National Parks in Africa. However, there are a handful of cases where these approaches have been successful at conserving biodiversity in National Parks.(Html, 2013).

Particularly, based on distribution of endemic-vascular-plant richness (EVPR), micro- hotspots, were identified among the richest floristic territories of the Sardinian and Baetic regions, and Nano-hotspots, among the richest 1-km2 grid cells of Sierra Nevada and Gennargentu massifs, located within these regions. In addition, environmental drivers were explored of EVPR, performing both simple- and multiple-regression models (Canada's *et al.*, 2014). Genetic resources enable plant breeders to create novel plant gene combinations and select crop varieties more suited to the needs of diverse agricultural systems (Glaszmann *et al.*, 2010). Population density is a key parameter to monitor endangered carnivores in the wild (Aziz *et al.*, 2017).Genetic diversity allows crops to evolve and adapt and is a major resource for plant breeders to use and meet the challenges in maintaining food security and environmental stability. Plant varieties stored in gene banks allow the agricultural communities access to genetic diversity to develop the most suitable and cost-effective crop variety for their specific needs (Gixhari *et al.*, 2013). Development of suitable approaches to the analysis of genetic diversity in a spatial context, where factors such as pollination, seed dispersal, breeding system, habitat heterogeneity and human influence are appropriately integrated, can provide new insights in the understanding of the mechanisms of maintenance and dynamics of populations (Torres, 2003).

It is becoming increasingly important to monitor unintended consequences of anthropogenic changes on natural populations. Genetic monitoring is defined as quantifying temporal changes in population genetic metrics or other population data generated using molecular markers.

Monitoring, is distinguished which must have a temporal dimension, from assessment, which reflects a snapshot of population characteristics at a single point in time.(Schwartz *et al.*,2006). A central issue in conservation today is to identify biodiversity-rich areas (Cañadas *et al.*, 2014). Senior Associate, World Resources Institute, Washington, D.C.Identifying the elements of biological diversity and monitoring their changes through time is a daunting task. Africa has excited the imagination of explorers, naturalists, and conservationists more profoundly than any other continent. There is neither money nor trained manpower to implement comprehensive conservation programs in Africa today though the task of the conservationist in Africa is currently much greater and more urgent than it has ever been(Burley *et al.*,2019). The Protected Planet webpage provides maps and searching options with additional information from the WDPA, photos from Panoramio, and text descriptions from Wikipedia (Schmidt-kloiber & Wever, 2018). In 2010, the parties of the United Nations Convention on Biological Diversity (CBD) adopted the Aichi Targets for 2020,

Which include goals such as ―reducing the direct pressures on biodiversity and ―improving the Status of biodiversity by safeguarding ecosystems, species and genetic diversity (Proença *et al.*,2017).National Parks are a cornerstone for biodiversity conservation in Africa. Two approaches are commonly used to sustain biodiversity in National Parks. Past and current studies show that both approaches are generally ineffective in conserving biodiversity in National Parks in Africa(Html, 2013).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. 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 (Division, 1998).Moreover, and for sake of simplicity, the latter can be framed within the techniques used in long-term monitoring schemes and ecological field studies. Although. Biodiversity monitoring datasets may combine primary biodiversity observations from a single source, from different sources of the same type, or from different sources of different types ((Proença *et al.,* 2017). Different approaches embraced by the various communities. One goal of such a development would be the establishment of a co-located network of sites within one ecosystem with shared research and monitoring tasks that provides modular data for flexible and multi-purpose uses.A collocated network of sites could be constituted by collaboration between, for example, an

LTER site, a NATURA 2000 site and a Critical Zone Observatory that are located within the same ecosystem. Based on the expertise of scientists from different long- term environmental monitoring communities, the objective of this paper is to provide a conceptual framework that serves as an improved guideline for future site-based long-term research and observation(Haase *et al.,* 2018). The integration of the EI and EBV frameworks would enable individual monitoring sites or co-located site networks within an ecosystem to

Capture essential ecosystem structures and processes in a more standardized and comprehensive way. In this manner, it was a i m e d to strengthen the biotic component of EI in particular, while simultaneously contributing important biodiversity data to global biodiversity monitoring through GEO BON. The overarching goal of EBVs provides a greater coverage of biotic data and the ability to upscale beyond individual sites (Haase *et al.*, 2018). Nations around the world are required to measure their progress towards key biodiversity goals. One important example of this, the Convention on Biological Diversity‘s 2010 target, is soon approaching. The target set is to significantly reduce the rate of biodiversity loss by the year 2010. However, to what extent are the data, especially for tropical countries, available to indicate biodiversity change and to what extent is current knowledge of biodiversity change trul y a global picture? While species richness is greatest in the tropics, biodiversity data richness is skewed towards the poles. In order to effectively mitigate biodiversity loss, greater investment of conservation attention is required in tropical regions where there is the most to lose. Broad-reaching global legislation may provide an impetus for such investment (Collen *et al.*, 2010).

How effective, given these patterns, was assessed the current CBD biodiversity indicators may be at measuring trends. We describe ongoing efforts aimed at addressing the geographical discrepancy of data, and how effective these might be at helping countries to evaluate their progress towards the 2010 target. As this is a critical period for addressing this data disparity, we provide number recommendations on how this might be achieved. Eight headline indicators in the CBD focal areas ‒Status and trends of the components of biodiversity and ‒Sustainable use were reviewed. Each headline indicator was assessed to determine the geographic coverage that it could apply to, as well as its current ability to provide adequate data for tropical countries to measure their progress toward the 2010 target (Collen *et al.*, 2010). These challenges are reflected in policies at multiple scales such as the United Nations Conventions on Biological Diversity (CBD) Strategic Plan and Aichi Targets for
2020.The grand challenge for biodiversity informatics is to develop an infrastructure to allow the available data to be brought into a coordinated coupled modeling environmental able to address questions relating to our use of the natural environment that captures the ‗ variety, distinctiveness and complexity of all life on Earth‘s(Hardisty *et al.*, 2013)

LTER, ILTER and the ecosystem integrity (EI) framework

LTER is a general umbrella term for site-based long-term ecological research and monitoring. LTER represents formal national, continental and global in-situ networks of research sites, and

Also independent long-term research sites and communities. By investigating cause-effect relationships, the LTER community strives to support local to global environmental research and decision-making through a better understanding of ecological and socio-ecological processes under global change. The novelty of such networks is the ability to collaborate among site-based projects, thus improving data usage for detecting trends and facilitating the analysis of ―combined effects‖ . LTER sites and national networks have mainly been developed in a bottom- up manner. This entails that sites were established for different research and monitoring purposes potentially resulting in different research foci. These sites cover a wide variety of ecosystem types, plot sizes, infrastructures, and instrumentation, and individual sites measure a wide range of biotic and abiotic variables ac- cording to site-specific requirement (Haase *et al.*, 2018).

Accessing biodiversity

Biodiversity assessment is one of the major challenges for ecology and conservation. With current increase of biodiversity loss during the last decades, there is an urgent need to quickly estimate biodiversity levels. This study aims at testing the validity of new biodiversity indices based on an acoustic analysis of choruses produced by animal communities (Depraetere *et al.*, 2012).The lack of data on tropical biodiversity will impact the efficacy with which indicators are able to accurately portray biodiversity change in tropical countries. out of the eight headline indicators that were assessed, only two appear to have sufficient coverage to deliver comprehensive progress measures for tropical countries(collen *et al.*, 2010). our study assessed whether environment and space could predict variation in the composition patterns of tree and shrub species in the extra tropical region of south America(Leite *et al.*,2018). In the last three decades, several indices have been developed to assess biodiversity(Depraetere *et al.*, 2012).Vast Germplasm collections are accessible but their use for crop improvement is limited efficiently accessing genetic diversity is still a challenge. Molecular markers have clarified the structure of genetic diversity in a broad range of crops. Recent developments have made whole-genome surveys and gene-targeted surveys possible, shedding light on population dynamics and on the impact of selection during domestication. Thanks to this new precision, Germplasm description has gained analytical power for resolving the genetic basis of trait variation and adaptation in crops such as major cereals, chickpea, grapevine, cacao, or banana. The challenge now is to finely characterize all the facets of plant behavior in carefully chosen materials. Broadening is suggested the use of core reference sets‘so as to facilitate material sharing within the scientific community. A crop core reference set is to be understood as a set of genetic stocks that are representative ofthe genetic resources ofthe crop and are used by the scientific community as a reference for an integrated collections have been analyzed with molecular markers and reduced to potential core reference sets of 50–500 accessions depending on the crop. This is currently the case for all resources managed by CGIAR-hosted germplasm centers, which are best positioned to deal with the pressing constraints of intellectual property legislation and quarantine regulations (Glaszmann *et al.*, 2010). Assessment of diversity of Albanian National Inventory is carried out using import statistics by passport descriptors from Plant Genetic Resources database. Flora of Albania identified more than 3 250 species of plants, but only 2% of them are included in the National Inventory (NI) of Albania in EURISCO catalogue. Albanian National Inventory of Plant Genetic Resources in EURISCO (2% of Albanian Flora) includes 33 genera, 62 species and 2111 accession, where 54% of them are collected genetic materials (Gixhari *et al*., 2013). Our study assessed whether environment and space could predict variation in the composition patterns of tree and shrub species in the extra tropical region of South America (Leite *et al*., 2018). Assessing change using diversity indexes in principle any measure of diversity (e.g. species richness, a diversity statistic such as the Shannon or Simpson index, heterozygosity, and an index of functional or trait diversity. This article has focused on the role of statistics derived from long-term datasets to describe biodiversity change. Their scientific uncertainty is assessed through combining several known sources of statistical error, some discussed here, including measurement precision, sampling procedures and basic ecological processes such as species turnover. While this allows the scientific questions to be answered, environmental policymakers reach decisions based on expert knowledge, existing research and statistics, and stakeholder consultation (Magurran *et al*., 2010).

Vast germplasm collections are accessible but their use for crop improvement is limited—efficiently accessing genetic diversity is still a challenge. Access to genetic diversity contained in large germplasm collections continues to be a significant challenge(Glaszmann *et al*., 2010). Coral reef ecosystem is the most threatened ecosystem among marine ecosystem in the world due to the combination of anthropogenic and natural disturbances. More research is needed to be monitored and assess coral reef ecosystems, which will be used to find understanding of the ecological integrity and further improvement of the protection strategy in the future (Muchtaromah, 2013). Biodiversity assessment is one of the major challenges for ecology and conservation. With current increase of

Biodiversity loss during the last decades, there is an urgent need to quickly estimate biodiversity levels. This study aims at testing the validity of new biodiversity indices based on an acoustic analysis of choruses produced by animal communities(Depraetere *et al*., 2012).Assessment was restricted of allelic variation to loci that were poly- morphic globally across all populations within species(Whitlock *et al*.,2016). We considered only AFLP fragment presence alleles, since identification of null alleles is ambiguouswhen they are present at low frequency. Biodiversity assessment is one of the major challenges for ecology and conservation. With current increase of biodiversity loss during the last decades, there is an urgent need to quickly estimate biodiversity levels. This study aims at testing the validity of new biodiversity indices based on an acoustic analysis of choruses produced by animal communities(Depraetere *et al*., 2012). To assess endemic vascular-plant richness (EVPR), we used the absolute endemism of each region. Thus, after compiling a list of plant taxa endemic to each region (i.e. regional endemics), we built a presence/absence data matrix for the 22 selected floristic territories (Canada's *et al*., 2014).

Modular ecosystem monitoring

The proposed approach could be applied for various purposes, such as further developing an already highly instrumented site to ultimately cover all variables of the EI and the EBV frameworks. Alternatively, several existing sites, which differ in their level of instrumentation and may belong to different community's operation history and specificity of research questions, could form together a network of co-located sites monitoring the full suite of variables in an ecosystem. Such modularity in ecosystem monitoring allows for a wider use of site-based research and monitoring data and cross-network communication. For example, networks focusing on different questions could simultaneously incorporate data fromother networks, in addition to their own collected data (Haase *et al.*, 2018).

Monitoring programmes are being used increasingly to assess spatial and temporal trends of biological diversity, with an emphasis on evaluating the efficiency of management policies. Recent reviews of the existing programmes, with a focus on their design in particular, have highlighted the main weaknesses: the lack of well-articulated objectives and the neglect of different sources of error in the estimation of biological diversity. The term monitoring has been used to describe many types of activities. Here, we define monitoring as the process of gathering information about some system State variable at different points in time for the purpose of assessing system state and drawing inferences about changes in state over time. Because we focus on the monitoring of biological diversity, the systems of interest are typically ecosystems or components of such systems and the state variables of interest include quantities such as species richness, species diversity, and biomass and population size. Different approaches can be used to develop an understanding of system behaviour and dynamics (i.e. to meet scientific objectives) from monitoring data. The approach that yields the strongest inferences involves monitoring in conjunction with manipulation of the studied system for the specific purpose of testing or evaluating hypotheses of interest (Yoccoz *et al.*, 2001).

Genetic monitoring offers some ofthe best opportunities to track populations over time and to evaluate when populations reach critical thresholds that demand management action. Category I genetic monitoring has many of the benefits of traditional abundance, distribution and vital rate monitoring, with the added benefit of larger and, in some cases, more representative samples owing to the relative ease of non-invasive genetic sampling. Most regular monitoring efforts will yield useful information, even though the most valuable aspects might not be apparent until decades later. To maximize prospects of obtaining useful results, numerous factors should be considered in monitoring program design(Schwartz *et al.*, 2006). However, there are limitations to recognize and cautions to heed when implementing genetic monitoring programs. As genetic monitoring is a relatively recent phenomenon, most studies using molecular tags to generate trends in abundance have asked whether the population has changed in size over only one or two time intervals. This type of monitoring can evaluate population characteristics before a monitoring program begins, as technical advances provide increasingly reliable DNA recovery from archived material. Genetic monitoring is defined as quantifying temporal changes in population genetic metrics or other population data generated using molecular markers. Monitoring, is distinguished which must have a temporal dimension, from assessment, which reflects a snapshot of population characteristics at a single point in time(Schwartz *et al.*,2006).

Assessment of diversity of Albanian National Inventory is carried out using import statistics by passport descriptors from Plant Genetic Resources database. Flora of Albania identified more than 3 250 species of plants, but only 2% of them are included in the National Inventory (NI) of Albania in EURISCO catalogue (Gixhari *et al.,* 2013). Data that can be used to monitor biodiversity, and to gauge changes in biodiversity through time, are essential. However, lack of information on the background rates and direction of change in ecological systems can make it difficult to detect the signature of anthropogenic impacts. Moreover, ecologists are increasingly aware that they have limited knowledge of temporal changes in ecological communities Such modularity in ecosystem monitoring allows for a wider use of site-based research and monitoring data and cross-network communication (Magurran *et al.*, 2010).

Discussions

How to make use of the existing EI and EBV was outlined frameworks for future site-based ecosystem research and monitoring. In particular, we recommend a list of variables, methods, and instrumentations that we regard as important for representing the state of ecosystems and biodiversity. This list was developed to harmonize measurements across ecosystems and focuses on the requirements of the EI and EBV frameworks. The benefit of the merging of these frameworks is that the variables listed are commonly used in ecosystem- tem monitoring (Haase *et al.*, 2018). The ratio of endemic plant species in Turkey (over 3000 species) to total plant diversity in the world is 1.3%. Being(Harun, 2010).The impact of three different soil DNA extraction methods on bacterial diversity was evaluated using PCR-based 16S ribosomal DNA analysis(Philippot *et al.,* 2001) We also identified some species having portions of the climatic niche represented by citizen science data that were not found in the climatic niches using the atlas data set. This was found for a small number of species (eight) and only for two of them this novel‘ portion of the niche represented more than 6% of its total niche breadth(Tiago *et al.*,

2017).This study represents the most thorough assessment to date of as- sumption violations and model diagnostics when fitting Poisson N- mixture models. Our results confirm that the N-mixture model is a reliable abundance estimator when detectability is $\geq$ 0.3, but the results also demonstrate that the N-mixture model produces mean abundance estimates with substantial bias with even slight amounts of unmolded heterogeneity in the count data‘s(Duarte *et al.*,2018). Line intercept method had been used to measure the cover percentage of coral reef life form. The result revealed that there were 45 species of coral reef obtained from this study, where genus Acropora is the most dominant genus found than the other genera(Muchtaromah, 2013).Decisions about which variables to monitor are determined largely by the objectives of the monitoring programmes; that is, by the answer to why monitor?‘M o n i t o r i n g programmes directed at scientific objectives should focus on the state variables and associated rate parameters that are important to the priorihypotheses of system behaviour. Biological diversity can be studied and managed at levels of biological organization ranging from genes to ecosystems. Ecologists have developed an almost endless number of diversity indices (e.g. Shannon-Weaver and Simpson; Box 1), but most of them can be seen as weighted sums of the relative abundances of species. Whereas original measures of species diversity focused primarily on the relative abundances of each species, recent proposed measures have incorporated Many measures of species, or ecological, diversity (D) can be seen as special cases of a general weighted sum of the relative abundances of different species(Yoccoz *et al.,* 2001).

Monitoring purposes, and second, taxon groups respond differently to pressures and differ in their distribution patterns(Proença *et al.,* 2017). Later is a general umbrella term for site-based long- term ecological research and monitoring. LTER represents formal national, continental and global in- situ networks of research sites, and also independent long-term research sites and communities (Haase *et al.*,2018). Monitoring animal populations is central to wildlife and fisheries management, and the use of N-mixture models toward these efforts has markedly increased in recent years. Nevertheless, relatively little work has evaluated estimator performance when basic assumptions are violated. Moreover, diagnostics to identify when bias in parameter estimates from N-mixture models is likely is largely unexplored. Count data sets was simulated using 837 combinations of detection probability, number of sample units, number of survey occasions, and type and extent of heterogeneity in abundance or detectability.We simulated population and monitoring count data using the scenarios outlined above as a foundation(Duarte *et al.,* 2018).

Extensive monitoring schemes maximize geographic coverage at the expense of sampling effort per site, expressed as the number of ecosystem variables or functional groups monitored and/or sampling frequency consequently; extensive monitoring schemes tend to focus on popular and conspicuous species groups, such as birds and butterflies. Intensive monitoring schemes, meanwhile, invest in the effort per site at the expense of geographic coverage. Long-term monitoring schemes for non-vertebrate taxa are still scarce and should be targeted by future monitoring efforts. New programs, such as the National But- terfly Monitoring Schemes in Europe The adoption of common protocols by future monitoring programs would be the most straightforward way to promote the integration of collected data(Proença *et al.*,2017). Hybridization regular monitoring with molecular markers can provide early detection of hybridization, thus giving managers a wider range of options than is available if introgression is already extensive before detection. It is becoming increasingly important to monitor unintended consequences of anthropogenic changes on natural populations(Schwartz *et al.*, 2006).

Concluding remarks and future directions

Many current monitoring programmes are believed suffer from deficiencies associated with inadequate attention during programme design to the why, what and how of monitoring. The general recommendation for those interested in establishing new monitoring programmes is that substantial thought should be devoted to the basic questions of how,what and why Such a recommendation is also applicable for ongoing programmes, which, in some cases, could potentially be greatly improved by some measures of biological diversity require estimates of abundance for the different species in the community. When abundance estimation is based on a monitoring programme covering a large area, it is important to incorporate two sources of error; that is detectability a situation where a large area of interest is surveyed using simple random sampling, and assume that there are Possible plots(Harun, 2010).Genome studies applied to crop germplasm shed light on the role of selection, foundations, migrations, and introgressions on population patterns, genomic associations, and genic diversity(Glaszmann *et al.*, 2010). We stress that there is no substitute for an effective sample design, and we recommend managers develop clear objectives for management prior to implementing monitoring programs or be flexible to adjustments in current monitoring efforts. With objectives in mind, managers are able to simulate monitoring data under various sample designs to establish more efficient and effective monitoring programs. Monitoring for the sake of monitoring without clear management objectives may result in data that cannot reliably estimate the population state variable(s) of interest (Duarte *et al.*, 2018).

Biodiversity monitoring and evaluation plan should, therefore:

Answer a clearly stated set of questions 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. 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. 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.

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 indica- tors for monitoring both changes in threats and the effectiveness of project interventions in mitigating those threats. 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. 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. Information gathered through M&E activities are useful both for assessing the impacts of individual project and to provide input into the design and implementation of future biodiversity projects and ongoing biodiversity management progmmmes gathered.

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