



Biodiversity monitoring and indicators:

Guidelines for integrating monitoring programs and indicators in projects within the context of the National Biodiversity Strategy and Action Plan for Lebanon.

**TOP-UP BIODIVERSITY ENABLING ACTIVITY PROJECT
LEB/03/010 & LEB/97/G31**



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ABBREVIATIONS

| | |
|-------|---|
| AUB | American University of Beirut |
| CBD | Convention on Biological Diversity |
| IBSAR | Initiative for Biodiversity Studies in Arid Regions |
| LEDO | Lebanese Environment and Development Observatory |
| MOE | Ministry of Environment |
| NBSAP | National Biodiversity Strategy and Action Plan |
| NGO | Non-Governmental Organization |
| UNDP | United Nations Development Program |

Background

By re-emphasizing the contribution of biodiversity to poverty alleviation and to the benefit of all life on earth, the Conference of the Parties (decision VI/26) committed themselves to achieve a significant reduction of the current rate of biodiversity loss by the year 2010, through a more effective and coherent implementation of the three objectives of the Convention.

For this purpose the Conference of the Parties provided a flexible framework within which national and regional targets may be set, and indicators identified (decision VII/30)

The development of these biodiversity indicators should take into consideration that they constitute information tools needed to assess the extent to which NBSAP and therefore CBD targets have been met and to signal key issues to be addressed through policy interventions and other actions.

Lebanon is in the process of establishing a system for tracking how its National Biodiversity Strategy and Action Plan is being implemented, whether main objectives are being achieved and if targets are met.

While recognizing challenges in designing relatively simple indicators to capture changes in biodiversity which is dynamic and mobile, biodiversity in Lebanon faces great socio-economic and political pressures. For example a change in the population of a particular species or habitat may be directly affected by lack of compliance to existing policies and regulations which could lead to off project site activities that are detrimental to these species. Accordingly indicators and monitoring programs should be designed to capture several levels: Indicators should encompass, in addition to biotic and abiotic criteria, socio economic criteria as well as policy and legislation. Such a combination of indicators would show actual impacts of actions and activities rather than merely measuring processes.

Focal areas proposed for monitoring by COP (decision VII/30).

- (a) Reducing the rate of loss of the components of biodiversity, including: (i) biomes, habitats and ecosystems; (ii) species and populations; and (iii) genetic diversity;
- (b) Promoting sustainable use of biodiversity;
- (c) Addressing the major threats to biodiversity, including those arising from invasive alien species, climate change, pollution, and habitat change;
- (d) Maintaining ecosystem integrity, and the provision of goods and services provided by biodiversity in ecosystems, in support of human well-being;
- (e) Protecting traditional knowledge, innovations and practices;
- (f) Ensuring the fair and equitable sharing of benefits arising out of the use of genetic resources; and
- (g) Mobilizing financial and technical resources, especially for developing countries, in particular least developed countries and small island developing States among them, and countries with economies in transition, for implementing the Convention and the Strategic Plan.

Despite all scientific efforts we still lack a clear understanding how the pressures we are imposing on nature are impacting biodiversity and our knowledge of species remains patchy and disconnected. We need to design clear and relatively simple indicators that are readily understood by policy makers and the general public. We need to use these indicators to effectively communicate the status and trends of biodiversity and to explain and relay the impact of ongoing planned activities and how these mitigate the pressures we are causing and reduce the loss of biodiversity.

Targets of the National Biodiversity Strategy and Action Plan for Lebanon

The Lebanese National Biodiversity Strategy and Action Plan was published in 1998. Its preparation involved 44 national experts (contributors, technical consultants, steering committee) and 500 individuals from local communities.

The Lebanese NBSAP includes 5 thematic areas that are considered relevant nationally and address directly existing situations and limitations, and 8 cross cutting issues that are addressed either as separate chapters due to the national relevance and relative independence of the issue or are included within thematic areas. An addendum to the NBSAP was prepared to elaborate on each proposed objectives.

The thematic areas of the NBSAP are:

1. Terrestrial ecosystems and natural habitats
2. Fresh water biodiversity
3. Marine biodiversity
4. Agrobiodiversity
5. Urban biodiversity

The cross cutting issues of the NBSAP are:

- A. In-situ conservation
- B. Biosafety
- C. International cooperation
- D. Public sector involvement
- E. Participation of civil society
- F. Knowledge generation through basic and applied research
- G. Knowledge dissemination and application through awareness raising and capacity building
- H. Development and update legislation, policies, mechanisms, and incentives
- I. Benefits sharing and economic opportunities

Addendum to the National Biodiversity Strategy and Action Plan

The addendum to the NBSAP was produced to translate the goals and objectives of this document into defined actions. The development of the addendum was based on a holistic approach that takes into consideration various scientific, social, and economic aspects and highlights prevalent cross cutting issues (right diagram). In addition, a brief description of possible indicators that could be considered and elaborated at the initiation of each proposed action.



The Purpose behind this document

This document provides guidelines for designing a monitoring program and indicators for all proposed projects and activities within the context of the NBSAP. These guidelines were developed in accordance to the information published by the clearing house of the CBD and other relevant published information (sources listed to right). The information is used to elaborate and guide the development of biodiversity indicators as information tools that relate field information to policy making and to help assess national performance and evaluate progress readily towards nationally set targets.

These guidelines are designed to help the Ministry of Environment involve partners in such a way to ensure short and long term sustainability in monitoring national activities and their impact on biodiversity

<http://www.biodiv.org/programmes/socio-eco/tourism/guidelines.asp?page=9>
<http://www.biodiv.org/biosafety/issues/others.aspx>
<http://www.biodiv.org/doc/meetings/sbstta/sbstta-03/official/sbstta-03-07-en.pdf>
<http://www.biodiv.org/recommendations/?m=SBSTTA-06&id=7033&lg=0>
<http://www.biodiv.org/programmes/cross-cutting/indicators/default.asp>
http://www.biodiv.org/doc/decisions/_Toc69633853
<http://www.biodiv.org/doc/meetings/ind/emind-01/official/emind-01-02-en.doc>
<http://www.biodiv.org/doc/meetings/ind/emind-01/official/emind-01-01-add1-en.pdf>
<http://www.biodiv.org/doc/meetings/bs/mop-01/official/mop-01-06-add3-en.pdf>
<http://www.biodiv.org/doc/meetings/sbstta/sbstta-09/official/sbstta-09-10-en.doc>
<http://www.biodiv.org/gbo/contents.asp>
<http://www.biodiv.org/doc/meetings/ind/tegind-01/information/tegind-01-01-inf-02-en.doc>
<http://www.biodiv.org/doc/meetings/ind/tegind-01/other/tegind-01-info-sbstta-09-10-en.pdf>
<http://www.biodiv.org/doc/meetings/sbstta/sbstta-07/information/sbstta-07-inf-08-en.doc>
http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/006/W3242E/W3242E00.HTM
http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/005/y4001e/y4001e00.htm
http://www.fmf.ca/pa_ABM.html
<http://www.deh.gov.au/land/publications/rangelands-monitoring/chapter3.html>
<http://www.geog.ucl.ac.uk/~gthack/swansea/bdmon.html>
http://www.businessandbiodiversity.org/action_monitor.html
<http://www.cs.umb.edu/efg/CommSci/Monitoring.htm>
<http://www.countdown2010.net/biodiversity.html>
<http://www.canadiancontent.net/en/jd/go?Url=http://www.strategyguide.org/ebmf.html>
http://www.escarpment.org/Monitoring/mon_forestbio.htm
<http://www.jncc.gov.uk/page-1823>
<http://www.stat.colostate.edu/~nsu/starmap/pps/urquhart.msts.links.pdf>

Framework for monitoring and indicators

Indicators should reveal status and trends of biodiversity and the effectiveness of the measures taken within the framework of the NBSAP (Right diagram). This type of monitoring is called for under Article 7 (b) of the Convention. Its results should be a contribution to the global task of measuring the rate of loss of biodiversity.

Indicators and the associated monitoring program should be designed to detect changes in time frames and on the spatial scales and these changes should be relevant to policy objectives and decisions.

Indicators should provide a clear message that can be communicated to and used by decision makers and the general public. This is achieved by selecting indicators that link monitoring, research and evidence based policy making.

Steps for monitoring national performance towards CBD 2010 targets

| Actors | Step | Action |
|--|-------------------------|--|
| Policy makers, scientists, civil society | NBSAP | Define policy issues and goals |
| Policy makers, scientists, civil society | NBSAP addendum | Establish terms of reference for proposed objectives and actions |
| Project expert teams | Project proposal | Design project to solve problems as stated in NBSAP and develop clear local indicators that are relevant for short and long term monitoring to assess project impact |
| Project expert teams, MOE | Project monitoring | Develop and implement short term monitoring program with project team |
| MOE, Public sector, civil society | Biodiversity monitoring | Develop and implement long term monitoring program beyond project duration |

Guidelines for the design of biodiversity indicators

What are indicators? Indicators must define objectives in a concrete and measurable way meaning that they must be verifiable. Indicators should include a measure of quantity, quality, time, target group, target species, target habitats, location and space. The more detail is included in the indicators, the easier it will be to assess feasibility of monitoring and reporting.

The Executive Secretary of the CBD listed a large number of available and potential indicators. These included 53 indicators for general application, 41 for forest biodiversity, 19 for agrobiodiversity, 24 for inland waters biodiversity, and 13 for marine and coastal biodiversity.

The Executive Secretary also lists 60 sources of information from international and regional organizations (UNEP/ CBD/ SBSTTA/ 9/ 10) (example of table excerpt below)

INDICATIVE LIST OF INDICATOR INITIATIVES AND SOURCES OF INFORMATION 4

| Organization | Title | Types of information | Address |
|---|--|--|---|
| <i>International and regional organizations or information of international or regional scope</i> | | | |
| Bird Life International | Indicators of avian biodiversity | Threatened species (global), Important Bird Areas (sites; currently limited to Africa and Europe but being extended to global) and common birds (habitats; Europe at present) | http://www.birdlife.org |
| European Commission, Joint Research Centre | Composite indicators of country performance | Background information on a workshop on composite indicators of country performance including a state-of-the-art report on current methodologies and practices for composite indicator development http://www.jrc.ecc.eu.int/uasa/pj-comp-ind.asp | http://webfarm.jrc.ecc.eu.int/uasa/index.asp?app=jrc&prj=frames&sec=home&dic=1&mode=6&webSite=/uasa/&head=8&menuopen=1&start=yes&Home=/uasa/events/occd_12may03/index.htm |
| European Commission, European Statistical Laboratory | The Dashboard collection | Lists of indicators for the environment and sustainable development, various countries and Europe | http://esl.jrc.it/de/index.htm |
| European Community | European Community Biodiversity Clearing-House Mechanism | Information on biodiversity monitoring and indicators: international and national initiatives with website links | http://biodiversity-chm.eea.eu.int/information/indicator |
| European Environment Agency (EEA) | Building agri-environmental indicators | The publication focuses on use of the Land Use/Cover Area Frame Statistical Survey (LUCAS) for building landscape and agri-environmental indicators. Analysis of independent and joint use of land cover information, administrative data and geo-referenced statistical surveys for providing information on fluxes, stocks and pressure indicators and data sets EU-wide. Topics range from bird diversity, to a complete land cover classification. | http://www.eea.eu.int/ http://agrienv.jrc.it/publications/ECpubs/agri-ind/ |
| European Environment Agency (EEA) | Fragmentation of ecosystems and habitats by transport infrastructure | Indicator fact sheet | http://themes.eea.eu.int/Sectors_and_activities/transport/indicators/consequences/fragmentation/TERM_2002_06_EUAC_Fragmentation_final_draft_August_2002.pdf |

Key questions that indicators may help to answer

Properly designed indicators may shed light on common concerns regarding the implementation of the Convention on Biological Diversity when they encompass five core key questions:

| | | |
|---|---|---|
| <p style="text-align: center;">STATE</p> <p>What is changing? to what extent? What is the current state of biodiversity? What is the rate of biodiversity loss and how is it changing? Is the status of biological diversity stable or changing? What is the direction and extent of the change? How many globally or regionally important species, populations and habitats are at risk of extinction? What is the species abundance and/or distribution (evenness), species-richness, and ecosystem structure and complexity of important ecosystems? How much biodiversity (landscape/ ecosystem diversity, natural habitats, species and genetic resources) is being lost? Are there early warning signs of problems that require early attention?</p> | <p style="text-align: center;">Why is it important?</p> <p style="text-align: center;">USE</p> <p style="text-align: center;">Why is it important?</p> | <p style="text-align: center;">PRESSURE</p> <p style="text-align: center;">Why is it changing?</p> <p>What is the possible impact of threats and what is their relative contribution? What is the size of these threats, and are they stable, decreasing or growing? What is the threat status of known genetic resources, species, ecosystem types, and habitats of poorly known taxa? What anthropogenic processes have the greatest influence on the current and near future status of biodiversity? Which social and economic root causes are responsible for the observed changes in human threats to biodiversity? Are direct and/or underlying causes of biodiversity loss being addressed?</p> |
| <p style="text-align: center;">Why is it important? USE Why is it important? What is the current state of the goods and services provided by biological diversity? What sustainable use practices are in place and how sustainable are they? Are the benefits derived from consumptive and non-consumptive uses known?</p> | | |
| <p style="text-align: center;">RESPONSE</p> <p>What are we doing about it? Are management efforts targeted to the highest priority threats? Is progress being made in achieving major targets and objectives set out in planning processes, in particular to reduce and prevent biodiversity loss? Are there known perverse management activities, incentives and policies? Is there a protected area network and how representative is it? How effective are/have been the measures taken to implement the Convention? Are management efforts, including resource allocation, in relation to present and past threats sufficient to slow the rate of loss of biodiversity and prevent irreversible loss?</p> | <p style="text-align: center;">Why is it important?</p> <p style="text-align: center;">USE</p> <p style="text-align: center;">Why is it important?</p> | <p style="text-align: center;">CAPACITY</p> <p>Do we have the means to formulate and implement response measures? How much human and institutional capacity is available to implement the Convention? How much support (financial resources, institutional support and incentives) from national and international sources is currently being provided to implement the Convention? What additional means (including new and additional financial resources) are needed to address the threats? What is the management capacity to quickly react to known (e.g. poaching, fires) or unforeseen (e.g. oil spills, new diseases) threats? What is needed to build the required capacity (according to national priorities)? What is the capacity to effectively manage priority areas? What is the national capacity to put expert (national or international) and traditional knowledge on status and trends of biodiversity to use for slowing down biodiversity loss? What is the capacity to maintain information flow?</p> |

How to select and define indicators. Indicators should be clear and measurable to allow for an effective contribution towards local, regional, or national monitoring of biodiversity and to provide internationally relevant information on reported changes. Indicators should primarily be quantitative (who/what, how many/how much, when, where) although qualitative indicators are also important to determine whether objectives have been met. When describing the qualitative aspect of an indicator, it is important to incorporate the views and perceptions of beneficiaries, as quality is often a subjective value, based on opinion.

- ⌚ Proposed indicators should be clear and readily verifiable
- ⌚ Proposed indicators should be based on local criteria to suit local situation and capacity for long term monitoring
- ⌚ Proposed indicators should be based on preliminary findings identifying stakeholders that will be involved in long term monitoring activities

How to validate indicators. Each indicator must be supported by evidence. This includes where the information will come from so that the indicator can be monitored, and who will be responsible for generating the information on a regular basis. It should also describe the method of collecting the information. This information will be used to verify the indicator.

By validating the indicator the following will be elucidate:

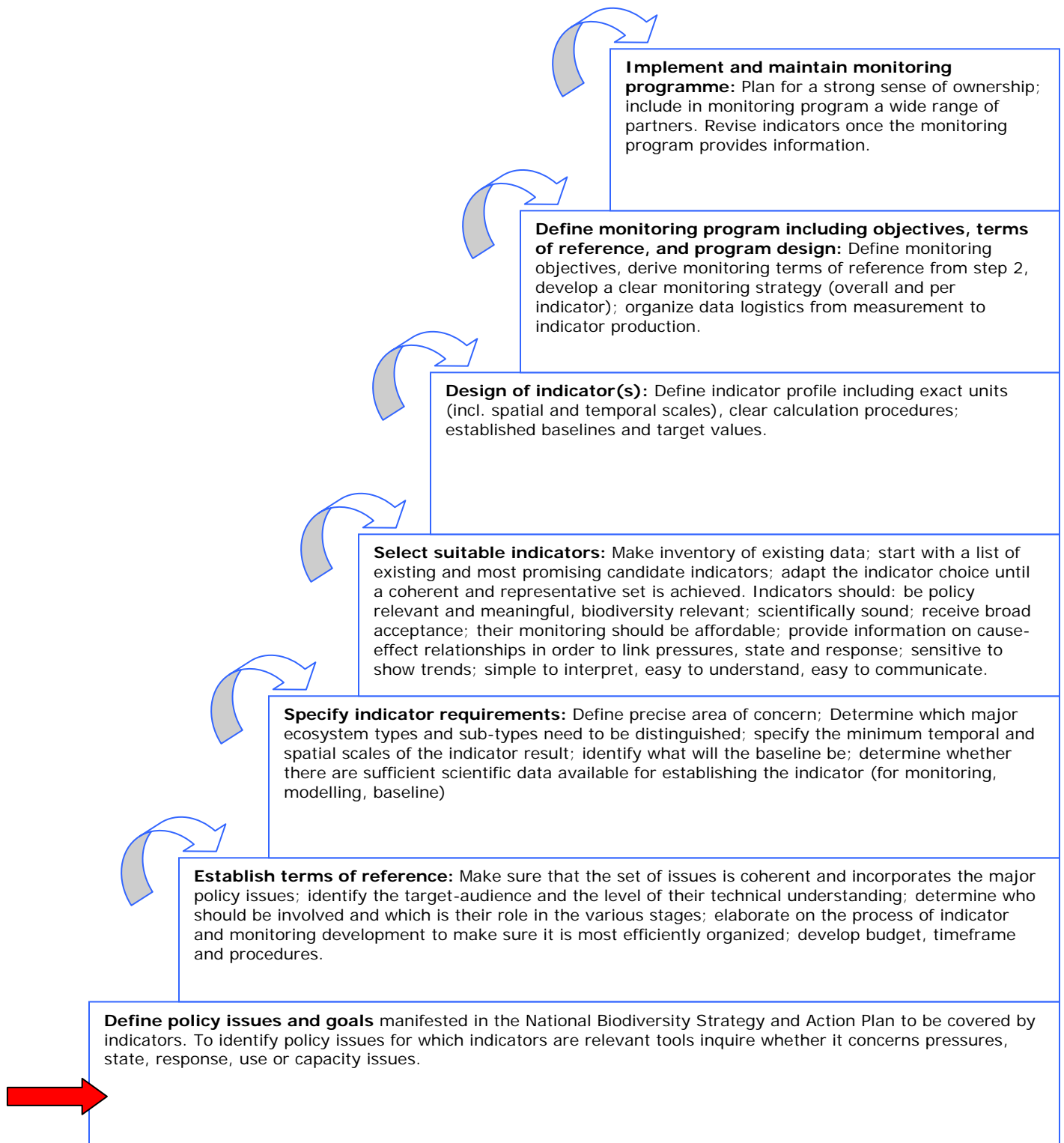
- Can the indicator be measured at reasonable cost by existing sources and proposed procedures?
- Is the responsibility for gathering data clearly assigned during the project duration and after project termination?
- Can the information gathered be easily used to monitor and evaluate biodiversity changes during the time frame of the proposed project, or beyond project termination date at a defined time interval?
- If additional procedures are required do they include information on cost? And are these costs acceptable?

The development of indicators for various habitats, species, thematic areas and cross cutting issues, has been developed by various international organizations (reference above). The challenge is to select indicators that are most suitable to stated project objectives and adaptable and sustainable at national levels considering national situations and capacities.



| Objective | Indicators | Means of Verification | Assumptions |
|--|---|--|--|
| What does the project want to achieve? | How can we tell if we have achieved it? | Where can we get information that will tell us this? | What else must happen if it is to succeed? |

Steps to develop indicators



What to avoid ✘ when designing indicators.

✘ Indicators are scientific tools designed to assist scientists better understand the changes in a given species or habitat

✔ Indicators are the “eyes and ears” of society they are a prerequisite for adaptive and cost-effective policies.

✘ Only scientists can and should understand indicators

✔ "keep it simple" indicators need to be well understood by policy makers and the public.

✘ For every objective scientists should conduct research and take the needed time to identify the perfect indicator or set of indicators to fulfill their objective.

✔ A scientifically perfect indicator does not exist, a politically useful one does. Choosing indicators is not just a matter of science but also a matter of experience and of weighting different factors.

✘ The selection of indicators should be comprehensive and the number should not be limited to make sure that all aspects have been taken into consideration.

✔ Choosing indicators is the art of measuring as little as possible with the highest possible policy significance. The number of indicators is a balance between costs and information needs.

✘ The selection of indicators should be performed by scientists only because they are the experts in biodiversity.

✔ Choosing indicators is a cooperative exercise between policy makers and scientists. This guarantees that indicators are policy relevant (targets, baseline choice), affordable, easy to monitor, ecosystem relevant, linkable with socio-economic scenarios (modelling response-pressures-effect relationships) and reliable. Single indicators provide detailed information, they may also represent the building bricks for composite indicators. Composite indicators provide general overviews often useful for policy making and communication with the public.

✘ The stakeholders should be informed about the selected indicators but there is no need to involve them in their selection.

✔ Consultation with stakeholders enlists their participation and consequently increases the effectiveness of indicators as policy and management tool.

✘ The number of suitable indicators should be very large because biodiversity is extensive and all its components should be represented.

✔ The number of suitable indicators is limited and therefore arbitrary choices are inevitable: Biodiversity is too extensive to allow measurement of all its components. Only a smart, representative subset of indicators in a limited number of sample areas can and needs to be measured.

Checklist towards successful design of indicators.

*I*ndicators do not have to meet all criteria

*N*o need to wait for ideal situations, get started, learn by doing

*D*o not get stuck on concepts, like key-stone species, etc... they are not goals

*I*ncomplete data is common start with the information and indicators you already have

*C*oncentrate on human-caused changes, not on natural fluctuations

*A*im at an accuracy that leads to policy making not to write scientific articles

*T*arget species that are easy and cheap to monitor and may provide significant information

*O*ptimize selection to produce indicators which can be used on different scales and purposes

*R*ome was not built in one day nor will the development of indicators, aim at a few, simple and feasible indicators in the short term (1-5 years); if possible undergo a gradual development and improvement in the long term (15 years)

Guidelines for the design of biodiversity monitoring programs

All those who will monitor, all individuals or groups that will be involved in the monitoring activities, should be identified and categorized in a primary, secondary, and tertiary category of monitors. The purpose is to see how and when monitors in each category will be involved.

Primary monitors: Individuals and groups that constitute the project experts team and that effectively design the indicators. They include scientists, experts, project managers, and all individuals employed by the project whether from local communities or not.

Secondary monitors: Individuals and groups that are not essential for the implementation of the project activities but are important to ensure that all project indicators are properly monitored. These include partner organizations, government focal points and departments, volunteer groups.

Tertiary monitors: Individuals and groups that may not be involved in project but are essential to ensure long term sustainability of proposed monitoring activities of established indicators. These include municipalities, as well as the private sector, volunteer groups from local communities.

An analysis of all individuals and groups that will be involved in monitoring biodiversity according to proposed indicators is essential as it builds baseline information on level of involvement and support and helps identify incentives and problems related to long term monitoring requirement. Such an analysis will also identify capacity building and training needs to ensure adequate data collection. It will also help define methodology and streamline it for long term data collection and analysis. Furthermore to ensure long term sustainability of biodiversity monitoring it is important to identify relations and expectations of the monitors. For instance the following inquiries need to be made to develop incentive measures that will ensure broader base participation in the monitoring process.

1. What are the expectations of the monitoring teams/volunteers from this activity?

2. What benefits will they likely receive from monitoring activities?

3. What resources or time involvement will they commit?

4. What interests do they have that may conflict with the monitoring activities?

5. Is the monitoring team qualified to conduct the monitoring exercise or did it receive the proper training to conduct monitoring activities?

Documentation on the roles and tasks of the monitoring teams should include an analysis of the monitoring capacity and predict possible scenarios that might lead to failure in sustaining biodiversity monitoring. Below is an example of ways to input the needed information.

| Hierarchy of monitoring teams | Representing organization | Experience and expertise | Focus and interest | Problems and issues |
|--------------------------------------|----------------------------------|---------------------------------|---------------------------|----------------------------|
| Primary monitors | | | | |
| Secondary monitors | | | | |
| Tertiary monitors | | | | |

During project activities issues related to monitoring strategy and process should be addressed and evaluated in a timely manner to ensure sustainability of biodiversity monitoring. Below are examples of the questions that should be raised during project implementation.

| | Task not initiated (expected date of initiation) | Task partially completed (expected date of completion) | Task fully completed (Date of completion and reference to task) |
|---|---|---|---|
| Community ownership of project: Does the local community agree with the stated objectives and to what extent will they be willing to support implementation | | | |
| Policies support: Is there evidence that the local authorities will put in place the necessary policies and resources for mainstreaming | | | |
| Physical capacity: Do the secondary and tertiary monitors have the adequate tools to monitor indicators as designed | | | |
| Human resource capacity: Do the local communities have the adequate human resources and incentives to invest in long term monitoring activities. If weak what has the project put in place to build capacity in this regard | | | |
| Have all potential monitoring teams been identified | | | |
| Have monitoring individuals and teams been categorized clearly | | | |
| Have the indicators been clearly defined | | | |
| Has the monitoring methodology been clearly elaborated | | | |
| Have all potential monitoring teams received adequate training to conduct monitoring activities | | | |
| Have all resources been allocated or considered to ensure sustainability of long term monitoring | | | |
| Social conditions: Do the local communities have harmony in their relations or is there underlying historic conflicts that might affect success | | | |
| Long term financial viability: Are there provisions to secure financial support for long term monitoring activities | | | |

Once the teams have been clearly defined a framework for reporting should be develop to standardize and streamline information.

How to relate biodiversity monitoring and indicators with existing facilities and ongoing projects in Lebanon?

The Ministry of Environment has already put in place a mechanism to acquire, standardize, and disseminate information on environment and environment related data and indicators.

This mechanism, the Lebanese Environment and Development Observatory (LEDO), which was launched in 1999, is one of a group of Observatories launched along the Mediterranean countries by an initiative of the Blue Plan office. The establishment of LEDO was made possible through a fund by the European Commission Life-Third Countries program executed by the Ministry of Environment under the management supervision of UNDP.

LEDO's main activities are to gather and provide open access to environment and development data, to provide proper information and better understanding of the state of the environment and development in Lebanon, to establish a national platform for environment and development information gathering, sharing and dissemination, and finally to establish a continuous environmental monitoring system based on environment and development indicators.

LEDO has established 90 environment and development indicators for Lebanon. The selection of these indicators was partially based on a set of 130 indicators identified by the Mediterranean Commission on Sustainable Development (MCSO) for the Mediterranean region and on priorities identified by national LEDO partners.

The selected indicators for biodiversity monitoring should be integrated within this existing LEDO. Once these are defined, incentives should be developed to ensure regular and widespread contributions aiming at completing and updating this existing database for the benefit of all and for facilitating regional and international reporting.

Indicators developed by LEDO

I - Population and Socio-Economic indicators

A- Demography

Population density *Inhabitants/ sq. km*

Urbanization rate %

Urban population growth rate %

Population density in coastal area
Inhabitants/ sq. km

Population growth in coastal area %

Rural- urban migration *Persons/ unit area*

Life Expectancy at Birth *Years*

B- Standard of Living

Infant mortality rate *Number per 1000*

Access to safe drinking water % of total pop.

Adult illiteracy rate for females and males
%

Economically active females and males %

Unemployment rate for females and males
%

Difference between male and female
school enrolment ratios %

Distribution of GDP % per sector

External Debt/ GDP %

Openness rate of GDP %

GDP per capita *US\$*

Income distribution (low, intermediate,
high) %

Human poverty index (HPI) -

Women per 100 men in the labor force per
sector

Number per 100 men per sector

Total water demand per sector *Mm³/year or
%*

Annual energy consumption per inhabitant
Ton oil equiv. per capita

Generation of municipal solid waste
Kg/inhabitant/yr.

Generation, imports and exports of
hazardous waste *Metric tons/ yr.*

Destination of household waste %

Composition of municipal waste %

Cost of management of municipal solid
waste % of GDP

II - Economic Activities

A- Agriculture

Use of agriculture pesticides *Tons of active
ingredient per 1000 hectares*

Use of fertilizers per hectare per
agriculture land *Kg N and Kg P per hectare*

Share of irrigated agricultural land %

Agricultural water demand per irrigated
area *M³/year/ha*

B- Industry

Unlicensed small & medium industries %
of total number

New industrial establishments *Number/
category/year*

Non-categorised industrial zones *Number
or sq. Km*

Number and area of industries in non-
categorized zones *Number and sq. Km*

Number of quarries and amount of
quarried material produced *Number and
tons per year*

C- Energy

Share of production of renewable energy
resource %

Annual energy consumption or
consumption per GDP *Gigajoules or
Gigajoules/GDP*

D- Services

Number of tourist hotel nights per
hundred inhabitants *Number per hundred
inhabitants*

Number of international tourist per 100
inhabitant *Number per hundred per habitant*

Currency balance due to tourism
activities *US\$*

Number of visitors to protected areas
Number

Number of tourism establishments on
coastline *Number*

Number of passenger cars per 1000
inhabitants *Number per 1000 inhabitants*

Stocks of motor vehicles per age
Number/age bracket

Stocks of motor vehicles per fuel type
Number/type

Indicators developed by LEDO (cont'd)

III- Environment

A- Air

Emissions of greenhouse gases
Gigagrams of CO₂ equivalent/year
Emissions of Sulfur Oxides *Tons of SO₂
equivalent/year*
Emissions of Nitrogen Oxides *Tons of NO₂
equivalent /year*
Emissions of low level ozone *g/m³ or ppm*
Consumption of Ozone depleting
substances *Tons per year*
Concentration of particulates *g/m³ or ppm*

B- Water

Sea water quality *Quantity per volume and
quality classes*
Industrial releases into water *Tons/day*
Share of distributed water not
conforming to quality standards *% of total
nb of water distribution units or % of total
population*
Water global quality index *Mg/lit or % of
samples complying with standards*
Ground water quality index *Mg/lit or % of
samples complying with standards*
Surface water quality index *Mg/lit or % of
samples complying with standards*
Share of collected & treated wastewater
by the public sewerage system %
Amount of wastewater collected by
sector (industry /domestic) %
Amount of wastewater treated by sector
(industry /domestic) %
Area irrigated with treated/untreated
sewage *% of total irrigated area*

C- Land / Soil

Forest area *Hectares/%*
Artificialized coastline/total coastline %
"Arable land" per capita *Ha/inhabitant*
Ratio of land exploitation %
Land use change *Km² and %*
"Arable land" change %
Wet land area *Km² and %*
Area affected by desertification *ha or %*
Number & area of illegal discharges
(open dumps) *Nb and m²*

D- Biodiversity

Forest's protection rate %
Protected coastal area *Hectares*
Protection of specific ecosystems *Area & nb*
Threatened species %
Burnt forest area per year *% of total forest
area*

IV- Sustainable Development Activities & Policies

A- Activities / Actors

Number of agendas 21 adopted and
implemented by local authorities *Number*
Wastewater treatment rate before sea
release for coastal agglomerations over
100000 inhabitants %
Number of wastewater treatment plants
Number per type
Number of fixed air / water / coastal
water monitoring stations *Number*
Number of associations involved in
environment & sustainable development
issues *Number*
Rehabilitated quarried land *% of total number*

B- Policies and Strategies

Public expenditure on environmental
protection as a % of GDP %
Development programs/projects
concerning the less favoured rural zones
% of total
Total expenditures on protected areas *US\$*
Expenditure on waste management *US\$ as
% of GDP*
Projects undergoing EIA *% of total projects*
Ratified International Environmental
Conventions *Number*

How to relate biodiversity monitoring and indicators in Lebanon with existing facilities and ongoing regional and international projects?

In its effort to guide countries towards more efficient and coherent implementation of the three objectives of the convention and the achievement by 2010 of a significant reduction in the current rate of loss of biological diversity guidelines for the development of indicators and monitoring strategies have been developed and the information disseminated to countries through the Clearing House mechanism. During its ninth meeting in 2003 SBSSTA produced 2 key documents that guide and inform on the selection of indicators these are:

- ❏ Monitoring and indicators: Designing national level monitoring programs and indicators
- ❏ Proposed biodiversity indicators relevant to the 2010 target (example of single indicative indicators listed below)

National efforts should be made to reconcile between the existing databases and the recommended global agenda for biodiversity monitoring.

Annex I.

PROPOSED INDICATORS RELEVANT TO THE 2010 TARGET

| 2010 targets | Generic indicator | Illustrative list of indicators | Meaning | Some existing sources of information | Relation to MDG goals |
|--|-------------------------------|--|--|--|---|
| Significant reduction to the loss of biodiversity | | | | | |
| 1. Significant reduction of the loss of ecosystems | Size per ecosystem type | <ul style="list-style-type: none"> - Forest area by type - Area of dry and sub-humid lands by type - Inland waters area - Agricultural area by type - Coastal area by type - Built-up area | How much remains per ecosystem type (no conversion into other type). | FAO, NASA, UNEP/GRID EROS Data Centre, Wetland International, UNEP-WCMC, CIFOR, EFI, National land cover and land use statistics. Satellite data from: NOAA, Vegetation 4, Landsat, MODIS, others. | Eradicate hunger and poverty of people which depend on these ecosystems |
| | Ecosystems protected | Percentage and size of ecological region protected in | According to IUCN categories | IUCN, EEA, etc | |
| | Trends in ecosystem structure | Trends in: Forest -canopy cover -age -dead-living wood ratio -primary, secondary, plantation Marine communities -vital coral reef area -sea grass area -mangrove area -intertidal area -salt marsh area Agriculture -% (semi)natural area -other Inland waters -flood plain area | These variables of ecosystem structures can be used as proximate for species trends in case insufficient data on species trends is available | FAO, UNEP-WCMC, CIFOR, IUCN, NGOs, diverse remote sensing sources such as NASA, national institutes, etc GMA, GIWA, Ramsar Convention FAO WWA, Ramsar Convention | |

| 2010 targets | Generic indicator | Illustrative list of indicators | Meaning | Some existing sources of information | Relation to MDG goals |
|---|---------------------------------|---|---|---|--|
| | Trends in ecosystem functioning | Trophic integrity of ecosystems | | TSBF, FAO, ICLARM FishBase | |
| 2. Significant reduction of the loss of species | Trends in species abundance | Trends in: - Mammal species -large carnivores -large herbivores -other - Bird species - Reptile species - Amphibian species - Fish species - Plant species - herbious species - tree species - wild relatives - Butterfly species - other species | Show homogeneity process within ecosystem types at species level Show decline (gain) in quality of ecosystem type Show loss (gain) of productivity of ecosystems Species abundance can be expressed in e.g.: total numbers, population density, distribution, biomass, breeding pairs, etc | FAO, IUCN, UNEP-WCMC, WWF, Birdlife International, GBIF, national institutes, individual scientists, indigenous people, NGOs, etc | In case of species or communities of direct or indirect economic importance the indicators relate to MGD on hunger and poverty |
| | Red List | Red List: - vascular plants - mammals - birds - reptiles - amphibians - fishes - butterflies - other groups | Number of threatened and extinct species by group and their threat status | IUCN, WCMC, CITES, etc | |
| 3. Significant reduction of the loss of genes | Number of livestock breeds | Number of: -cattle breeds - goat breeds - pig breeds - sheep breeds - other species | Which genetic resources are threatened, being the basis of human food production | FAO, CGIAR centres, various national and regional institutes, ... | Eradicate hunger and poverty |
| | Number of crop varieties | Number of: - rice varieties - corn varieties - potato varieties - other | | FAO, CGIAR centres, various national and international institutes, ... | |

| 2010 targets | Generic indicator | Illustrative list of indicators | Meaning | Some existing sources of information | Relation to MDG goals |
|---|--|--|--|--|------------------------------|
| Threats to biodiversity | | | | | |
| 4. Control threats from habitat loss, fragmentation, | Loss area per ecosystem type Fragmentation | Converted area of: - Forest - Grassland - Tundra - Inland waters - Desert and semi-desert - Ice - Agricultural area Road density | How much of the natural ecosystems is lost? This is the reverse of the state indicator on extent of area Local impact by roads, industry, mines and urban area | Same as in 1. UNEP/GRID Arendal, etc | |
| 5. Control threats from exploitation | Exploitation | Harvested species in tons/year: - tree species - fish species - game species - cetaceans - others | Direct impact on the abundance of species | FAO, CITES, World Fish Centre, Millennium Ecosystem Assessment, various national and regional institutes.. | |
| 6. Reduce pressures from climate change, pollution | Climate change Acidification and eutrophication | Mean temperature Mean precipitation Nitrogen and Sulfur deposition in equivalents/km ² Nitrogen loads in rivers | Changing conditions for ecosystems and species Eutrophication and acidification by air pollution related to critical loads Conversion of natural ecosystems and intensified agricultural production often result in increasing riverine nitrogen fluxes and damage to aquatic and marine systems | IPCC, not measurable, should be modelled UNEP/GEO; RIVM (deposition models required) UNESCO-IOC Global Nutrient Export from Watersheds project; UNEP/GEO; SCOPE studies. | |
| Maintain and share benefits/services from biodiversity | | | | | |
| 7. Maintain capacity of ecosystems to deliver goods | Harvesting of species | Amount harvested: - tree species - fish species - game species - cetaceans | Harvest expressed in: - tons/year (as indicator 5) - US\$ - number of people depending on these natural resources | FAO, World Fish Centre, Millennium Ecosystem Assessment, national institutes, etc | Eradicate hunger and poverty |

| 2010 targets | Generic indicator | Illustrative list of indicators | Meaning | Some existing sources of information | Relation to MDG goals |
|--|---|--|---|---|---|
| | Income | - extensive cattle grazing Income from tourism Trophic integrity of inland waters and oceans | - contribution to Gross Domestic Product - US\$ - number of people depending on the sector - contribution to GDP - changes in trophic level of fishes and other aquatic taxa being exploited | World Tourism Organisation; World Travel and Tourism Council; Millennium Ecosystem Assessment, national and regional statistics, etc FAO | Eradicate hunger and poverty |
| 8. Maintain capacity of ecosystems to deliver services | Climate regulation Soil stability Flood/drought control | Carbon sequestration Pg C/yr. ecosystem type (Petagram of C per year) Total suspended solids in main rivers River flow characteristics major rivers (hydrograph) | Especially for forest, but other ecosystems contribute too. Relation with vegetation cover and land use; River flow characteristics will become more extreme (flooding and droughts) due to loss of water holding capacity of the catchment area as a result of conversion of natural ecosystems in agriculture and built-up area, deforestation and unsustainable soil management practices. | IPCC, FAO, Millennium Ecosystem Assessment, ... Not measurable, models required UNESCO, USGS, EEA, various national and regional institutes.. GRDC-Koblenz ; IGBP-BAHC; various national and international institutes, etc | Ensure environmental sustainability Eradicate hunger and poverty Eradicate hunger and poverty |