# DRAFT: The Outcomes Monitoring framework: Detailed indicator descriptions

## Elizabeth Kennedy

# I. Introduction

Historically the conservation community has not employed a systematic, consistent framework for measuring the status of conservation targets (species, sites, or landscapes/seascapes) (Balmford *et al*. 2003[1]; Royal Society 2003[2]). This has impeded our ability to conclusively and quantitatively demonstrate that conservation actions are (1) the right ones, (2) in the right place, and (3) achieving the conservation results we intend. Being able to accurately monitor the status of biodiversity in relation to our conservation investments is extremely important, particularly in light of the recent decisions at the World Summit on Sustainable Development and the Convention on Biological Diversity where the world's leaders agreed to significantly reduce the current rate of biodiversity loss by 2010 (United Nations 2002a[3]; United Nations 2002b[4]).

CI has been working closely with other conservation organizations to develop a systematic and objective approach for measuring conservation success. Drawing from prior efforts, CI's current Outcomes Monitoring protocol contains an essential, institution-wide set of indicators that are our best proxies for reporting on the status of species, area, and corridor conservation outcomes. Outcomes monitoring provides the overarching framework from which to develop context specific effectiveness monitoring systems.

The primary purpose of outcomes monitoring is to consistently measure progress toward avoiding extinctions, protecting key biodiversity areas, and consolidating biodiversity conservation corridors. Outcomes monitoring is not intended as a complete monitoring system, but the indicators proposed herein for outcomes monitoring are considered to be practical, achievable, globally applicable, and strongly correlated to achievement of conservation outcomes. By implementing monitoring of species, areas, and corridor indicators, the complementary set of indicators provides a robust framework to consistently quantify the status of biodiversity in Hotspots and High Biodiversity Wilderness Areas. The indicators described in this document will strengthen our ability to report on progress and determine the effectiveness of strategies over time.

[1] Balmford, A., Green, R. E., and Jenkins, M. 2003. Measuring the changing state of nature. Trends in Ecology and Evolution 18: 326-330.
[2] Royal Society 2003. Measuring Biodiversity for Conservation. Policy document 11/03. Royal Society, London.
[3] United Nations 2002a. World Summit on Sustainable Development: Johannesburg Plan Implementation. United Nations, New York.
[4] United Nations 2002b. Convention on Biological Diversity, Conference of the Parties VI, Decision document VI/26 Strategic Plan).

In many cases, CI's Regional Programs and CBCs, support programs, or local institutions are already engaged in components of this monitoring work. In Hotspots and High Biodiversity Wilderness Areas where status monitoring is not currently occurring, CI is working to build up capacity, funding and partnerships to undertake monitoring of outcomes.

This section begins by providing a brief review of existing monitoring systems and a justification for the overall conceptual framework CI has selected to support outcomes monitoring. The indicators to be measured are then presented, followed by summary guidance to assist Regional Programs in implementing CI's Outcomes Monitoring protocol.

# II. Background

The most common basis for many existing monitoring frameworks is the Pressure-State-Response (PSR) framework. Simply put, human activities exert **pressure** on the environment through a range of social, political and economic activities. This pressure changes the quality and quantity, or **state**, of the environment. Society reacts to these changes through environmental, economic and policy **responses** (OECD, 1993[5]). These human responses to the changes include any organized behavior that aims to reduce, prevent or mitigate undesirable change or environmental results.

Although the PSR model provides a causal framework, it does have limitations. In particular, as a reporting framework it can over-simplify the complex dynamics within any ecosystem and misrepresent the causes of ecological change (Bossel, 1999[6]). Despite this limitation, the PSR model remains a useful way to organize our thinking when developing and reporting on indicators. PSR fits well with CI's own way of working, but because CI places great emphasis on conservation outcomes, changing PSR to ***State*-Pressure-Response** better illustrates the process by which CI monitors changes in state, identifies pressures, and then responds with conservation actions (Figure 1).

We arrived at a proposed set of indicators by collating indicators used by other efforts to monitor biodiversity conservation. These indicators were then organized into a matrix that cross-referenced species, area and corridor scales with state, pressure, and response. While the state indicators (Table 1) are the best measures of conservation outcome achievement because they measure the targeted conservation outcome (species, area, corridor), they are also more difficult to measure, requiring significant time, money, and skill. For CI's Outcomes Monitoring a set of pressure and response indicators have also been described. Pressure indicators are related to CI's **milestones**, since achievement of **milestones** (changes in behavior of the actors as identified exerting a particular pressure) is intended to result in a decrease in the pressures (e.g., hunting). The response indicators are related to CI's or another institutions' **outputs** (actions taken to achieve outcomes. Examples of

[5] OECD (1993). *OECD Core Set of Indicators for Environmental Performance Reviews.* OECD Environment Monographs No. 83. OECD, Paris, France.
[6] Bossel, H. (1999). *Indicators for Sustainable Development: Theory, Method, and Application.* Winnipeg, Canada, International Institute for Sustainable Development.

**outputs** include demarcation of borders of a protected area, passing new legislation, increasing enforcement, implementing compatible land use in a corridor, etc.

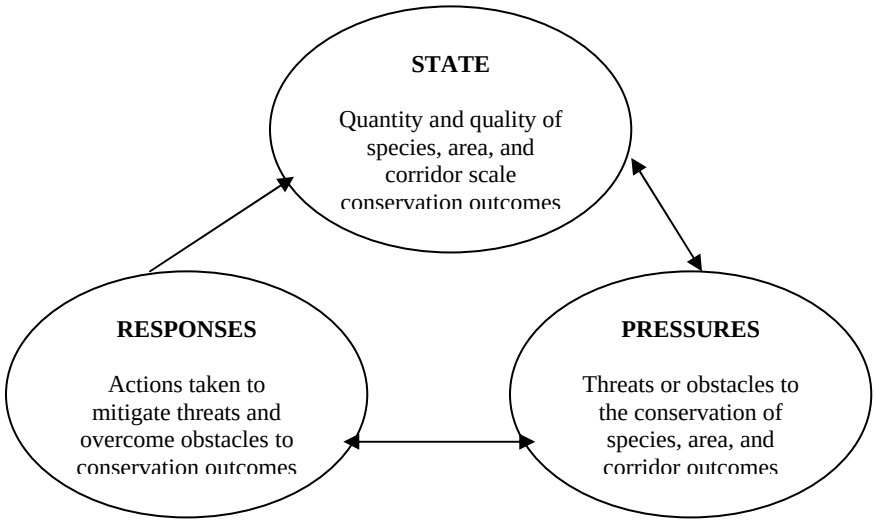


*Figure 1. Graphical representation of the State-Pressure-Response framework and the interactions between each variable type.*

It would be too complex to try to monitor every aspect of each environment where CI works. Regular measurement of indicators can quantify and simplify these complex realities by revealing trends or changes in the state of a system, population, or individual.

*Table 1. Priority indicators for measuring the status and trends of Conservation Outcomes.*

| Outcome Category | | Indicator Description | Outcome Target |
|---|---|---|---|
| Extinctions Avoided | **1** | **Percent change in number of threatened species in each IUCN Red List category, number of species downlisted, and number of species that have gone extinct.** | **No species on the Red List.** |
| Sites Protected | **2** | **Percentage and total number of all Key Biodiversity Areas that are protected with (a) legal recognition *and* (b) biodiversity conservation as an official goal.** | **All Key Biodiversity Areas have legal protection status, with biodiversity conservation as an official goal.** |
| | **3** | **Percent change in baseline habitat cover at Key Biodiversity Areas.** | **All Key Biodiversity Areas retain or increase baseline habitat coverage.** |
| Corridors Created | **4** | **Change in fragmentation statistics.** | **Baseline corridor connectivity is retained or increased.** |

# III. Detailed Indicator Descriptions

## A. SPECIES INDICATOR

This indicator covers the "Extinctions Avoided" Outcome. Currently this includes globally threatened species (Critically Endangered, Endangered and Vulnerable) listed in the IUCN Red List (www.redlist.org).

Regional Programs, CBCs and the Conservation Synthesis Department in Washington are currently working together to identify these species for each region.

### 1. Number of threatened species is reduced. (State)

***What is the indicator?*** Percentage change in number of threatened species in each IUCN Red List category, based on the number of species in each Red List Category, and the number changing categories between assessments as a result of genuine improvement or deterioration in status (Red List Index [RLI], Butchart *et.al.*, 2004[7]) .

**Suitable data for calculating RLIs are only available for birds, but indices for other taxonomic groups are in development. Also under development are RLIs using a stratified sample from all major taxonomic groups.**

***Why should this indicator be measured?*** The Red List is the best global assessment we have for identifying species in danger of extinction. One of the major outcomes for CI is avoiding extinction of species, so downlisting of all species from the Red List would constitute a complete success! RLIs complement trends in species population and habitat extent indicators for measuring trends in the status of biodiversity. A chief limitation is that the resolution of status changes is fairly coarse and that time may pass before status changes are detected. However, RLI's main strength is that they are calculated using virtually all species globally for a given taxonomic group, instead of a potentially biased subset.

***How should this indicator be measured?***

Percentage achievement can be determined by calculating the RLI for a Hotspot or High Biodiversity Wilderness Area using the number of species in each Red List category for each complete assessment and the number of species that change categories as a result of genuine status change. The categories considered should be the five principal categories on the IUCN Red List: Extinct (EX), Extinct in the Wild

[7] Butchard, S.H.M., Stattersfield, A.J., Bennun, L.M., Shutes, S.M.., Akcakaya, H.R., Baillie, J.E.M., Stuart, S.N., Hilton-Taylor, C., and Mace, G.M. 2004. Measuring global trends in the status of biodiversity: Red List Indicies for birds. PloS, 2(12). http://www.plosbiology.org/plosonline/?request=get-document&doi=10.1371/journal.pbio.0020383

(EW), Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT) [8].

Species may be downlisted or uplisted due to a real change of conservation status, reasons of taxonomic change or improved knowledge. Since we are most interested in real change in conservation status, it is important to separate out the other changes. Butchart et al, (2004) describe how this was done to calculate Red List Indices for birds[9]. Mutually exclusive codes were applied: (1) recent genuine status change; (2) genuine status change since first assessment; (3) knowledge; (4) criteria revision; and (5) taxonomy. The first two codes were used for relevant changes in calculating the indices, and the last three codes were used for change not relevant in calculating the indices.

It is also important to list the number of species downlisted from each category due to a real change in conservation status. Otherwise, successes with a couple of species could be lost in a wider wave of negative change. For example, if the percent change in the RLI for birds is –2.1 (see below for number explanation) between complete assessments, the number of species uplisted, resulting in the negative change, may mask the difference in number of species downlisted. It is important to actually track the number of species in each category and list how many have been downlisted due to a real change in conservation status.

The Red List index can be determined as follows:

1. For species that have been assessed in two consecutive assessments
    a. Multiply the total numbers of species in each category for each assessment by the corresponding category weight.
        i. NT=1
        ii. VU=2
        iii. EN=3
        iv. CR=4
        v. EW=5
    b. Sum the five products to calculate a total score **T** for each assessment ($\mathbf{T}t_{i-1}$, $\mathbf{T}t_i$; where $t_i$ is the year of the ith assessment).
2. For each category, determine the net number of genuine changes **G** between the two assessments.
3. Subtract the value of weight category **c** for species **s** at time $t_i$ [$W_c(t_i,s)$] from the value of weight category **c** for species **s** at time $t_{i-1}$ [$W_c(t_{i-1},s)$].
4. Multiply the difference in weight categories between assessments for species **s** times the number of genuine changes $G_s$ for category **c** . Where $G_s = 1$ if change in category of species **s** is genuine from $t_{i-1}$ to $t_i$ , otherwise $G_s = 0$.
5. Divide the product for each species by the total for the earlier assessment $\mathbf{T}t_i$

[8] IUCN. 2001. IUCN Red List categories and criteria: version 3.1 Gland, Switzerland and Cambridge, UK: IUCN SSC.
[9] Butchart op. cit.

6. Calculate the total proportional change $\mathbf{Pt_i}$ by summing the quotient for all species.
7. Finally, the value of the index $\mathbf{It_i}$ is calculated by multiplying $\mathbf{1- Pt_i}$ times the index for the previous period $\mathbf{It_{i-1}}$, where $\mathbf{It_{i-1}}$ equals 100 for the first year of assessment.

Mathematically the formulas are:

$$T_{t_i} = \sum_c W_c \cdot N_{c(t_i)}$$

$$P_{t_i} = \sum_s [(W_{c(t_i,s)} - W_{c(t_{i-1},s)}) \cdot G_s] / T_{t_{i-1}}$$

$$I_{t_i} = I_{(t_{i-1})} \cdot (1 - P_{t_i})$$

***Where should this indicator be measured?*** This assessment can be carried out from any office with Internet access and should evaluate all Red Listed species in the Hotspot or High Biodiversity Wilderness Area that have been globally assessed more than once.

***When should this indicator be measured?*** Once each year, after the Red List is updated.

***Who should measure this indicator?*** Most CBCs and Regional Programs have a person or team designated to do species work. They will be best placed to monitor the Red List. Support can be provided by teams in Washington if needed

**B. <u>AREA INDICATORS</u>**

These indicators cover CI's "Areas Protected" Outcomes for Key Biodiversity Areas, including new protected areas, improved management of existing areas, and conservation in indigenous areas. Key Biodiversity Areas at which these indicators should be measured include:

- Sites at which Critical or Endangered species are regularly present.
- Sites at which significant numbers of Vulnerable or restricted-range species are regularly present.

Regional Programs, CBCs and the Conservation Synthesis Department in Washington are currently working to identify and map these sites for each region.

**2. <u>Key Biodiversity Areas are formally protected</u> (Response)**

***What is the indicator?*** Total number and percentage of all Key Biodiversity Areas that are protected with (a) legal recognition or binding contractual protection *and* (b) biodiversity conservation as an official goal (e.g., national park, private protected area, easement, conservation concession, or multiple use protected area, community land, indigenous reserve , or land under corporate management *with declared boundaries and biodiversity conservation as a goal*). Responses should also include area (hectares) of these protected sites in total; area protected as a core zone (no extractive/consumptive uses permitted); and area protected as a multiple-use zone.

***Why should this indicator be measured?*** This indicator allows the measurement of regional and local variations of protected areas, and accounts for both the creation of new areas and the modification (or formalization) of the goals for existing areas. It is therefore a relatively complete way to capture the number of Key Biodiversity Areas protected both by controlled use and no-take zones.

***How should this indicator be measured?*** Overlay existing protected area maps (such as those available from the World Database on Protected Areas) with the maps of Key Biodiversity Areas and calculate the following: a) number of sites protected and unprotected; b) area of protected sites; c) area protected as core zones; and d) area protected as multiple-use zones. Measuring any major changes in internal zoning (e.g. creation of core zone from multiple use zones), and *reductions* in sites protected (e.g. de-gazettement of a protected area or retraction of the biodiversity conservation goal in an indigenous area) are essential. Any KBA that has some form of protection status should be counted, even if less than 100% is under protection. The type of protection status should be noted, and the area associated with any given protection status should also be recorded. Where possible polygon delineation for the different protected types should be recorded. Changes resulting from improved mapping of Key Biodiversity Areas or protected areas should be noted.

***Where are the important sites to measure?*** All Key Biodiversity Areas should be assessed.

***When should this indicator be measured?*** Annually.

***Who should measure this indicator?*** Staff trained in GIS in the CBC/Regional Program (or possibly a partner). Some support for this, if necessary, is available from the Conservation Synthesis Department in Washington.

***Notes*** Requiring that sites protected have both legal recognition and a conservation goal ensures that only sites which are most likely to contribute to conservation in the long-term are included. For example, an indigenous area with a clear statement of conservation objectives, in whatever form is locally appropriate, is more likely to promote those objectives in the long-term than a similar area that happens to protect biodiversity only because of low human population density. These requirements may nonetheless leave out key areas that *are* likely to function for long-term conservation. Examples include traditionally sacred parts of indigenous territory, a coffee company

that has (with no legal agreement) designated part of their land for shade coffee in a site providing conservation benefits, an indigenous reserve not explicitly protecting biodiversity but prohibiting all extractive uses, etc. The main problem with including these areas is potential lack of long-term protection – many traditional protections are fading, market fluctuations may result in a change in cropping patterns, and so on. However, regions can include cases, with justification, where there is good reason to believe that a protected area without a legal basis or direct conservation goal will provide long-term protection of biodiversity.

**3. <u>Habitat is conserved at protected Key Biodiversity Areas. (State)</u>**

***What is the indicator?*** Percentage change of baseline habitat cover at protected Key Biodiversity Areas.

***Why should this indicator be measured?*** Quantity of habitat is among the indicators most highly correlated with the ability of species to persist at any site. Further, changes in habitat cover can be measured by classification of satellite images and other remote sensing analyses, which makes it possible to generate at comparatively low cost a detailed picture of habitat change across large areas. While change in habitat cover does not capture many issues of habitat quality, not to mention that measuring habitat quality across a large area is prohibitively expensive and time-consuming ,these effects will often be addressed by the species studies described below (in the Additional Recommended Indicator Types section)..

***How should this indicator be measured?*** Satellite image-based change detection (both 500m and 30m resolution) with validation by aerial photography and ground surveys when possible.

Periodic (e.g., annual) change detection at 500m resolution from MODIS (or comparative substitute) images should be provided by the Regional Analysis program in Washington making use of existing methodologies and products. Only basic statistics of area cleared by region should be calculated from these change detections.

For change detection from 30m Landsat (or comparative substitute) images, the Regional Analysis program and CBCs/Regional Programs should work together to ensure that an appropriate and comparable methodology is used. Desirable characteristics include: (a) wall to wall classification (not sampling); (b) habitat change that is mapped from raw data rather than from a derived product; (c) methodology that can be independently checked for quality by some combination of raw images, change detection product and description of methods used; and (d) validation of classification with aerial photography or other groundtruthing. Classifications for the most recent 5-year period, as well as a baseline period (~1990 - ~2000), should be mapped.

***Where are the important sites to measure?*** Change detection should be completed for all Hotspots and High Biodiversity Wilderness Areas (see Corridors, below). For all protected Key Biodiversity Areas, deforestation rate should be calculated and compared

to baseline deforestation for the same area. *Methods are being reviewed and developed for habitats other than forested areas.*

A range of other measures can be calculated for specific sites where more detail is needed or useful (e.g. those where CI is active, etc.):

1. Deforestation rate at the site compared to present deforestation rate for similar or surrounding areas.
2. Fragmentation statistics, including patch size distribution, distance to forest edge distribution and connectivity indices (see Corridors, below).
3. Fragmentation statistics to assess the impact that habitat change may have on CR species.

***When should this indicator be measured?*** Assessments using MODIS (500m) images should be done annually. Assessments using Landsat imagery (30m) should take place approximately every 5 years or more frequently for key areas.

For critical areas, an up-to-date change detection assessment in combination with the baseline assessment (e.g., to assemble a 3-date change analysis) should begin as soon as possible. Some regions may reduce costs by waiting until a NASA - NGO data buy, likely in 2005, provides a number of free satellite images from that year. Areas that choose to wait should begin the baseline change assessment (2-date) prior to 2005, so that they need only add one date in that year.

***Who should measure this indicator?*** The Regional Analysis team in Washington and the CBC or RP point – person should work together in the initial stages of evaluating current initiatives (e.g. existing deforestation maps in Liberia, Brazil, Burma, Ecuador), engaging relevant institutions for collaboration or coordination, as well as for deciding on methods. These groups should then define a plan of action (workplan), including training needs, who should be consulted during analysis, who should conduct the actual change-detection analysis, options for validation, who should perform the follow-up data analysis, development of summary spatial statistics on fragmentation, etc.

## C. CORRIDOR INDICATOR

This indicator covers CI's "Corridors Consolidated" Outcome and demonstrates extent and distribution of suitable habitat for wide-ranging and migrant species. Regional Programs, CBCs, Regional Programs Divisions and Conservation Synthesis Departments in Washington are currently working to identify and map these corridors for each region.

### 4. Connectivity allows natural biotic interactions (State)

***What is the indicator?*** Habitat cover fragmentation statistics: specifically patch size distribution and distance to edge distribution.

***Why should this indicator be measured?*** The effects of habitat fragmentation include changes in ecological processes and functions. Although our present ability to predict specific changes is limited, it is recognized that habitat fragmentation is one of the most important threats to ecosystem integrity. As stated above in indicator three, it is recognized that change in habitat cover does not capture many issues of habitat quality that might affect species population levels. These effects will largely be captured by the species studies described below under "Additional Indicators".

***How should this indicator be measured?*** Fragmentation statistics compare spatial indices of shape and size, proximity and isolation, connectivity, and diversity of classes of land cover types. The deforestation maps generated in indicator three provide the basis for conducting fragmentation statistics. Free computer software programs such as FRAGSTATS are designed to compute a wide variety of landscape metrics for categorical map patterns (FRAGSTATS information and downloads are available at http://www.umass.edu/landeco/research/fragstats/fragstats.html).

***Where are the important sites to measure?*** All Hotspots and High Biodiversity Wilderness Areas, and where ***appropriate***, broken down by corridor. *Methods are being reviewed and developed to address habitats other than forested areas.*

***When should this indicator be measured?*** See indicator number three (Habitat is protected at key sites)

***Who should measure this indicator?*** See indicator number three (Habitat is protected at key sites)

***Notes***

- May not capture changes due to selective logging (only intensive forms)

Need additional R&D to operationalize several emerging tools.

# IV. Additional recommended indicator types

## A. SPECIES INDICATORS

### 1. Species on the Red List are downlisted (State)

***What is the indicator?*** Percentage improvement towards achieving downlisting of each threatened species, concentrating on rates of decline, starting with Critically Endangered species.

***Why should this indicator be measured?*** Removing species from, and even downlisting species within, the Red List is a slow and difficult task. Population-level studies can help us measure the incremental changes towards achieving this task for the most threatened species. While a number of factors (extent of occurrence [EOO], area of occupancy [AOO], number of locations at which a species occurs, and number of mature individuals in the population) contribute to the Red Listing of a species, the

most significant aspect (featured in c.70% of listings) is a *decline* in one of the factors listed above (e.g., EOO or population size). The limited number of remaining species are listed not because of population decline, but solely due to a very small population or very small range (which are often natural vulnerabilities that cannot be countered by conservation action). Thus, it is obvious that one of the key things to address is decline of threatened species. Ideally declines will not just be slowed or stopped but also reversed. However, as a first step this indicator concentrates on slowing and stopping declines.

***How should this indicator be measured?*** First, it is important to identify how to measure the rate of population decline of a species. Around 40% of declining species are listed under categories A or C1, and thus have estimated rates of decline intrinsically recorded in the Red List. For example, the Grey-cheeked Parakeet *Brotogeris pyrrhopterus* of the Chocó/Darién/Western Ecuador Hotspot is listed as 'Critical A1bcd'. This means that it has "an observed, estimated, inferred or suspected reduction of at least 80% over the last three generations, based on: an index of abundance appropriate for the taxon; a decline in area of occupancy, extent of occurrence and/or quality of habitat; and actual or potential levels of exploitation". Explanations of all of these terms, and full listings of the categories and criteria for each species can be found at www.redlist.org and, for birds, at www.birdlife.org/species/risk.cfm and www.birdlife.org/species/index.cfm respectively.

For species with known background rates of decline, it is possible to monitor decline rates into the future (directly, or using appropriate surrogates as listed for the species), and thus percentage achievement towards stopping declines. Percentage achievement per species per year will be:

$$\frac{[\textbf{decline in previous year}] - [\textbf{decline in current year}]}{[\textbf{decline in previous year}]}.$$

For example, if a species' decline slowed from 40% in one year to 35% in the next year, the achievement would be 12.5% ([40-35]/40). While such changes in decline rates may not be significant year-to-year (due to natural fluctuations, margins of error, etc.), cumulative multi-year monitoring will identify real changes in decline rates. As an indicator, it is most useful to present the mean value for all species studied and achievements towards stopping decline. The number of species for which success was achieved (i.e., declines stopped or slowed) should be listed.

***Where should this indicator be measured?*** Threatened species are found in every region where CI works, but most occur in the Hotspots so this indicator will be proportionately more important there. For example, the Philippines has 45 Critically Endangered vertebrates and 37 plants, but the whole of the Guianas CBC has only six Critical species. Studies can be most efficiently carried out in an area that has several threatened species, so that some of the data collected will be useful for more than one

study. Ideally, a study will take place across the entire range of a species, but more often a study in one part of the species' range can be used to indicate how well a species is doing over its entire range. Obviously care will need to be taken in choosing a subset of the species' range that is expected to be most representative.

***When should this indicator be measured?*** Most studies will take place during the species' breeding season, but this will depend on why the species is threatened. For example, some species may be threatened only in their non-breeding grounds (particularly some bird species which congregate at migratory or wintering sites). We should aim to carry out studies throughout every year for at least the Critically Endangered species that are on the brink of extinction. Less threatened species can be monitored less frequently.

***Who should measure this indicator?*** Regional Programs and CBCs should aim to study, facilitate studies, fund studies, or collate pertinent information from other studies, all Critically Endangered species (at a minimum). In many cases, small grants programs exist to fund studies like these (e.g., Haribon in the Philippines, WCS international small grants program, BP Conservation Awards). Some CBCs have found that it is most efficient to set up their own grant for targeting particular partners, such as universities, that have students who want to do biological field studies (e.g., Madagascar and Andes CBCs). *For more information on developing a grants program, contact the Outcomes Monitoring Support Program.* In initial stages, it would be good to study a cross-taxonomic range of species (mammals, birds, herbivores, fish, plants, and invertebrates), although this will not be possible in all regions. We should prioritize the most threatened species, followed by the restricted range species.

The most urgent priority is to downgrade species from the Critical level. Once Critical species are all being studied, Endangered species are the next highest priority for study. In High Biodiversity Wilderness Areas, where there are few threatened species, modeling future land-use change may show extensive and sizeable pressures over much of the range of currently non-threatened species. Such models allow inclusion of species on the Red List under criterion A3.

**2. <u>Species outcomes defined.</u>**

***What is the indicator?*** Percent of species outcome definition steps completed (Response)

***Details:*** Outcome definition is not yet complete in all regions, so steps towards initial completion of Outcome definition should be monitored. Also tracking changes in knowledge is necessary in order to track genuine changes in species' Red List status.

The four steps for Outcome definition are as follows, each one needing completion for progression to the next:

(i) List of all globally threatened species in region (CBC/Hotspot/country/HBWA/etc.) compiled.

(ii) Outcomes Database populated for all globally threatened species.

(iii) List of all restricted-range species in region compiled.

(iv) System in place for updating Outcomes Database as new information becomes available.
(v) Identification of newly listed species and changes in species Red List status due to changes in knowledge.

This indicator should be measured as the number of steps completed divided by the total number of steps to give a percentage completion. For example, if the Philippines CBC has completed up to step (ii), then their percent achievement is 40% (2/5).

**3. <u>Globally threatened species are being studied. (Response)</u>**

***What is the indicator?*** Percentage of threatened species with ongoing studies or conservation actions that focus on ecology, population, or distribution

***Details:*** Research on threatened species is often key to understanding exactly why they are threatened and how to conserve them. Thus it is important to monitor the percentage of all threatened species with ongoing studies or conservation actions focused on ecology, population or distribution. This can be done by continually updating the species background information workbook which tracks ongoing species research initiatives and funding.

**4. <u>Species are nationally protected. (Response)</u>**

***What is the indicator?*** Percentage of threatened species that have protected status in each nation

***Details:*** National legislation can often expedite species conservation. The percentage of threatened species that have protected status in each nation covered by the Hotspot or High Biodiversity Wilderness Area should thus be monitored. Legislative protection is ineffective if there is no concurrent enforcement of legislation. Thus, it is important to also note presence or absence of a public annual performance report from the relevant environmental enforcement agencies.

**5. <u>Commercial exploitation of globally threatened species is reduced. (Pressure)</u>**

***What is the indicator?*** Number of seizures of threatened species at international boundaries

***Details:*** While monitoring habitat loss and species populations provides valuable information about threats, just monitoring these two indicators can miss significant hunting, collecting, and trade pressures. Some monitoring should take place at the level of commercial exploitation of threatened species, but the design of the monitoring project will need to be region-specific. Basic export record monitoring through CITES or customs records will provide valuable information, but this can be built on, especially to monitor trends of in-country trade through targeted monitoring of wildlife trade at key links (airports, harbors, trade routes, markets, etc).

## AREA INDICATORS

### 1. Site outcomes defined. (Response)

***What is the indicator?*** Percent of site outcome definition steps completed

***Details:*** Following definition of species targets is the identification of Key Biodiversity Areas. The following steps are necessary for KBA identification:

(i) Key Biodiversity Areas identified for globally threatened species.
(ii) List of all restricted-range species in region compiled.
(iii) Key Biodiversity Areas identified for restricted-range species.
(iv) Key Biodiversity Areas identified for congregations of species.
(v) Outcomes Database populated with Key Biodiversity Area data.
(vi) System in place for updating Outcomes Database as new information becomes available.
(vii) Identification of newly defined Key Biodiversity Areas.

This indicator should be measured as the number of steps completed divided by seven (the total number of steps) to give a percentage completion. For example, if the Philippines CBC has just completed up to step (iv), then their % achievement is 57.1% (4/7).

### 2. Management plans developed for globally threatened species. (Response)

***What is the indicator?*** Percent of Key Biodiversity Areas with management plans to protect the residential threatened species.

***Details:*** Many areas under protection, even those with a general conservation focus, do not have specific objectives to protect threatened or restricted-range species, and activities therefore often do not focus on this goal. Creation of explicit goals to protect key species, and development of plans to achieve these goals, is a major step in focusing management activities. Each protected Key Biodiversity Areas should be evaluated for the presence or lack of appropriate species objectives and plans according to the following:

(i) Appropriate goals and plans
(ii) Appropriate goals but no plans
(iii) No goals or plans

### 3. Types of permitted uses for each Key Biodiversity Area (Response)

***What is the indicator?*** Percent change in Key Biodiversity Areas prohibiting destructive resource use.

***Details:*** The number of potentially damaging resource uses legally permitted in a protected site is an important determinant of political, social and legal support for management for conservation, ease of management, and overall ability to focus on conservation objectives. Each protected Key Biodiversity Area should be evaluated for

major uses *legally permitted* (or in the case of some areas, officially permitted by community law), according to the following key:

(i) Scientific study, low impact tourism and other non-consumptive non-extractive uses
(ii) Above plus non-commercial "traditional use" (e.g. low population densities, non-immigrant groups, largely traditional technologies, etc.)
(iii) Above plus non-commercial resource use by local people (e.g. higher population densities, can include migrants, largely new technologies, etc.)
(iv) Above plus sustainable commercial use
(v) Above plus commercial use

## 4. Implementation of Management (Response)

***What is the indicator?*** Several recommendations for indicators discussed below.

***Details:*** Protected areas of any kind need active management to be effective. While appropriate management activities vary widely depending on context, it is valuable to measure some quantitative indicators of the level of management implementation. The following are likely to be important in a range of contexts and should be evaluated, as appropriate, for protected Key Biodiversity Areas:

(i) *Personnel*: People enforcing the basic management goals of each area are often the foundation for all management activities. This can be measured by number of guards/wardens per km of border and/or per $km^2$ of area of formal protected areas or other appropriate sites
(ii) *Boundary demarcation*: Demarcation of boundaries (e.g., signs, use of natural features, fences) to make a protected site clearly identifiable to surrounding communities can be a critical step in avoiding resource use conflicts and supporting long-term effective management. Adequacy of demarcation for each site can be measured by calculating existing kilometer of boundary demarcation as a percentage of the total number of boundary kilometer under pressure. Kilometer of border under pressure can be estimated if necessary (e.g. using hunting camps, illegal logging roads, etc.).
(iii) *Local benefits*: The involvement of local communities and provision of tangible benefits from protected areas is often an important contributor to local support for management. Local benefits can be estimated by counting the number of the following that apply (range: 0-4):

1) The site provides employment as protected area staff
2) The site generates employment as guides, porters, etc.
3) The site provides direct benefit through sharing entrance fees, compensation, support for local projects, etc.
4) The site provides the base for the establishment of compatible industries providing employment, e.g. restaurants, hotels, etc.

(iv) *Local conflicts*: Conflicts are an important indicator of lack of local support. The number of major active disputes regarding land tenure or use rights can demonstrate and measure the extent of conflict.

(v) *Research Stations*: The presence of a research station is often indicative of significant interest in effective management, and research stations themselves often function to protect their immediate surroundings. This indicator can be measured by the percentage of Key Biodiversity Areas that have an operating field research station, which is identified by one that has active scientists for at least half the year.

## CORRIDOR INDICATORS

### 1. Corridor outcomes defined. (Response)

***What is the indicator?*** Percent of corridor outcome definition steps completed

The steps for delineating corridors are being refined, but currently are as follows:

(i) Conservation corridors delineated, based on the Key Biodiversity Areas as "anchors".

(ii) Outcomes Database populated with data for these corridors.

(iii) System in place for updating Outcomes Database as new information becomes available.

(iv) Identification of changes in corridor delineation or new corridors

This indicator should be measured as the number of steps completed divided by four (the total number of steps) to give a percentage completion. For example, if the Philippines CBC has completed step (i), then their % achievement is 25% (1/4).

### 2. Infrastructure development (Pressure)

***What is the indicator?*** Percent of corridors with infrastructure developments within xx kilometers of the boundary.

***Details:*** There is substantial evidence that demonstrates a correlation between habitat destruction and proximity of roads and other infrastructure projects. Incorporating spatial distribution of existing and proposed infrastructure, including roads, energy and pipeline projects, and mineral extractive industries, will improve corridor design and effectiveness. Thus it is important to monitor the presence (or absence) and proximity of KBAs to roads, pipelines, power lines, and mineral extraction projects. Regions can do so by holding the information in a database, maps, or through assessment reports. Specifics for this indicator will be developed on a region-by-region basis.

### 3. Legislation protects biodiversity (Response)

***What is the indicator?*** Change in number of legislative tools in place to protect biodiversity.

***Details:*** It is widely accepted that particular regulatory and legislative frameworks are important in achieving biodiversity conservation. Recent analysis of 114 legislative tools across 27 tropical high biodiversity countries resulted in the following list of 20 key laws or legislative tools.

i) Classification of lands as protected areas and forest reserves
ii)Promotion of mechanisms for the creation of protected areas
iii) Development of a National Park system
iv) Creation and protection of parks of the maximum possible size
v)Minimization of park's edge to core ratio
vi) Required Management Plan for any activity
vii) Ensured adequate funding for park system, including enforcement activities
viii) Establishment of buffer zones around protected areas
ix) Restricted use of buffer zones
x)Prohibition to set burns in forest terrains and surroundings
xi) Distance requirements to set up fires near forest areas
xii) Prohibition to introduce chemicals within forest domains or watercourses
xiii) Obligation to use chemicals in an environmentally friendly manner
xiv)Prohibition to introduce / propagate nonnative species that damage wildlife
xv) Inclusion of biological corridors as a management category
xvi)Creation of biological corridors to connect fragmented habitats
xvii) Management plans, Environmental Impact Assessments, and permit requirements for any forest exploitation
xviii) Establishment of general criteria and principles on Forest Management
xix)Prohibition of deforestation and illegal exploitation
xx) Prohibition to exploit or fell any protected tree

Regional Programs and CBCs should note the presence (or absence) of these twenty key legislation or legislative tools that are in place nationally to support biodiversity conservation provides a useful measure of the status of the enabling policy conditions of a region (ie. list the number of key legislation or legislative tools which are present at the national level).

## 4. Invasive species reduced (Pressure)

***What is the indicator?*** Change in number of invasive species present within the corridors.

***Details:*** The presence of non-native feral species is a principal biodiversity conservation management challenge. Non-native species are those species that would not be in the area without direct or indirect introduction by humans. An invasive species is a non-native species whose introduction does or is likely to cause environmental or economic harm, or harm to human health. Regional Programs and CBCs can begin by identifying the invasive species present in the corridors where CI works in order to inform development of CI corridor and species conservation strategies.

## 5. Land use plans and incentives for biodiversity friendly land use (Response)

***What is the indicator?*** Percent change in land zoning requirements that provide incentives for protection biodiversity.

***Details:*** Existence of formal land use plans, land titles, and land use legislation clearly establishes parameters for development. Identification and monitoring of land zoning considerations are constructive for the ongoing refinement of corridor strategy development. Some examples include:

(i) Legislation of incentive structures for forested area set aside on actively managed land outside of KBAs
(ii) Provisions for streamside buffer zones
(iii) Legislation of resource use rights.

Regional Programs should begin monitoring by identifying all land zoning requirements that provide incentives for protecting biodiversity.