USER'S MANUAL FOR THE CITY BIODIVERSITY INDEX

BACKGROUND

1. The ninth meeting of the Conference of Parties to the Convention on Biological Diversity (COP9) in Bonn, Germany, recognised the role of cities and local authorities and the fact that the implementation of national biodiversity strategies and action plans (NBSAPs) requires the close collaboration with sub-national levels of government. In light of the above, the Minister for National Development of Singapore, Mr. Mah Bow Tan, proposed the establishment of an index to measure biodiversity in cities, at the high level segment of COP9, on 27 May 2008. Following up on his proposal, the First Expert Workshop on the Development of the City Biodiversity Index (CBI) took place from 10 to 12 February 2009 at the Singapore Botanic Gardens, at the invitation of the National Parks Board Singapore (NParks), the Secretariat of the Convention on Biological Diversity (SCBD) and the Global Partnership on Cities and Biodiversity (GPCB).

FIRST EXPERT WORKSHOP ON THE DEVELOPMENT OF THE CBI, 10 TO 12 FEBRUARY 2009

2. The workshop was organised in close consultation with the members of the GPCB. The key objectives of the workshop were to develop the City Biodiversity Index (CBI), as a self-assessment tool, to:

(i) assist national governments and local authorities in benchmarking biodiversity conservation efforts in the urban context; and

(ii) help evaluate progress in reducing the rate of biodiversity loss in urban ecosystems.

3. A total of seventeen technical experts on biodiversity indicators as well as city executives and city representatives responsible for implementation and/or management of biodiversity and urban projects and programmes attended the workshop. These included four

cities (Curitiba, Montreal, Nagoya, and Singapore), experts from the London School of Economics, Stockholm Resilience Centre, Institute of Housing and Environment (Germany), National University of Singapore, the International Union for Conservation of Nature (IUCN), ICLEI – Local Governments for Sustainability's Local Action for Biodiversity (LAB) Initiative and the East Asian Seas Partnership Council. From the SCBD, Mr. Oliver Hillel, Programme Officer for Sustainable Use, Tourism and Island Biodiversity, attended the workshop.

4. Over the three-day workshop, the experts deliberated on the format of the index and agreed that it should comprise three components, that is:

(i) native biodiversity in the city,

(ii) ecosystem services provided by native biodiversity in the city, and

(iii) governance and management of native biodiversity in the city.

The first component focuses on different aspects of native biodiversity, in particular what native biodiversity are found in the city, how they are conserved, what are the threats to native biodiversity, etc. The second component concentrates on the ecosystem services provided by native biodiversity in the city, including those pertaining to regulation of water, carbon storage, and recreational and educational services. The third component is concerned with the governance and management of biodiversity, encompassing budget allocation, institutional set-ups, number of biodiversity-related projects, public awareness programmes, administrative procedures, etc.

The experts, divided into three groups, discussed in depth each of the components and decided on 26 indicators[1].

5. A technical task force, comprising Dr. Nancy Holman (London School of Economics), Mr. Peter Werner (Institute of Housing and Environment, Darmstadt, Germany), Professor Thomas Elmqvist (Stockholm Resilience Centre), Mr. Andre Mader (ICLEI-Local Governments for Sustainability LAB Initiative), Ms. Elisa Calcaterra (IUCN), Mr. Oliver Hillel (SCBD) and Dr. Lena Chan (NParks), was delegated to prepare the User's Manual for the CBI.

6. In recognition of Singapore's innovative contribution and leadership, the SCBD has informally named the CBI, "The Singapore Index on Cities' Biodiversity". In short, it may be called "The Singapore Index".

SECOND EXPERT WORKSHOP ON THE DEVELOPMENT OF THE CBI, 1 TO 3 JULY 2010

7. The Second Expert Workshop on the Development of the City Biodiversity Index was held from 1 July to 3 July 2010 at the Singapore Botanic Gardens, Singapore. The objectives of the workshop were to:

(i) Review comments by cities which have test-bedded the Index;

(ii) Refine and improve the indicators of the CBI based on the essence of the components that was agreed at the First Expert Workshop (paragraph 4); and

(iii) Finalise the User's Manual for the CBI.

8. Thirty-two participants, including the SCBD, the Technical Task Force, representatives from ASEAN Working Group on Environmentally Sustainable Cities, Brussels Capital Region, Curitiba, Edmonton, Montpelier, Montreal, Nagoya, Waitakere City, and Singapore, resource experts, representatives from Aichi-Nagoya COP10 CBD Promotion Committee and international organisations attended the workshop.

9. The deliberations of the workshop were recorded in the Report of the Second Expert Workshop on the Development of the City Biodiversity Index, UNEP/CBD/EW.DCBI/2/2. The participants examined the general approach to the selection of the indicators, crafting of the measurement of the indicators, and scoring of the indicators. Special attention was paid to ensure that the selection and scoring of the indicators were unbiased. Written feedback given was shared at the workshop and any concerns that were brought to our attention were addressed at the workshop. The decisions made during the workshop on the amendment of the indicators have been incorporated into the revised indicators attached in parts 1 and 2 of the attached City Biodiversity Index, dated 6 September 2010.

10. The following issues pertaining to the general approach to the formulation of the CBI were discussed extensively:

(i) Issue:

It was recognised that cities in the temperate region have inherently a lower diversity than cities in the tropical region. The age of the cities, human intervention and other processes of succession could also be factors affecting the biodiversity richness of cities. The size of the cities too is an important factor in determining the biodiversity richness of the city.

Discussion and Conclusion:

To ensure fairness and reduce bias, a number of amendments were made. First, it was agreed that the total number of ecosystems and total number of specific species be listed in the Profile of the City. The net change in species over time, where 2010 is set as the baseline year, has been identified as an indicator to replace the total number of species. Secondly, statistical analysis

1 Twenty-six indicators were identified at the 1st Expert Workshop. As two of the indicators were very similar, one of them was removed during the preparation of the User's Manual for the CBI, resulting in a total of 25 indicators in the November 2009 version.

based on the data from cities would be carried out. For the statistical analysis to be reliable, data input would be required from at least 20 cities. For a 4-point score, the mean from data given by the cites will be calculated and be used as the reference for the '2-point' score.

As the CBI is developed primarily as a self-assessment tool, the actual score of the indicators is secondary to the change in the score over time. Hence, the differences in the scores by cities in different ecological biomes, hence, should not be a cause for concern as cities are comparing how well they did in relation to their own past scores over a time period. The comparison among cities arose due to the availability of the data but is not the reason for the development of the CBI.

(ii) Issue:

The validity of a single score based on the summation of the scores of a diverse range of indicators was questioned. Another system, segregating different characteristics of the indicators into 5 sectors, i.e., A, B, C, D and E, and summing up scores of the different elements separately was counter-proposed.

Discussion and Conclusion:

The participants deliberated on the merits and drawbacks of the single score and the counter-proposal. The consensus of the workshop was that a single score, which was a total of the scores for all the indicators, was preferred as long as the indicators were fair.

(iii) Issue:

It was suggested that the ecological footprint of the cities should be included in the Index.

Discussion and Conclusion:

The participants were informed that this issue had been raised at the previous workshop. Since many other indices like the World Economic Forum's 2005 Environmental Sustainability Index and 2008 Environmental Performance Index, WWF's Living Planet Report 2008, and other cities' indices deal with ecological footprints and no other indices for cities, in particular, focus on biodiversity-related parameters, it was agreed that this Index should concentrate on native biodiversity, ecosystem services provided by biodiversity, and governance and management of biodiversity. By creating this niche, the Index could provide biodiversity-related indicators for other indices that lack these specialised but important parameters.

(iv) Issue:

For many of the cities, the extinction of species occurred more than a hundred years ago. It was beyond the control of the present generation.

Discussion and Conclusion:

While it was accepted that the extinction of species had taken place, it was not productive to dwell on it by focusing on extinct species. Positive steps need to be taken and these should be incorporated into the Index to encourage pro-active activities that would result in the restoration, rehabilitation and re-introduction of ecosystems and species. All the indicators, where necessary, have been revised to reflect this approach.

(v) Issue:

There were several feedback that insufficient attention was given to biodiversity in built-up areas, considering most cities comprise built-up areas and semi-natural cultural landscapes. The characteristics of built-up areas and brownfield sites differ in different cities and there was a need to arrive at a common understanding of these land-use features.

Discussion and Conclusion:

The participants agreed with the above observation. The indicator on native biodiversity in built-up areas, i.e., number of bird species, attempts to addresse this issue. One of the motivations of this Index was to promote the increase in native biodiversity in cities so as to reduce the rate of biodiversity loss. It has been increasingly shown many cities could have higher biodiversity than the countryside which are heavily sprayed with herbicides and pesticides. The Index is seen as dynamic and evolving in nature.

Positive indicators that aim to increase biodiversity like restoration, rehabilitation and re-introduction initiatives would most likely be added on at a later date.

(vi) Issue:

It was highlighted that for ecosystem services, it was difficult to isolate the services provided only by native biodiversity. Similarly, on governance and management, such actions are often directed at biodiversity in general. However, it is recognised that actions directed at the conservation and utilisation of native biodiversity should be encouraged

Discussion and Conclusion:

Therefore, components 2 and 3 were amended accordingly:

- ecosystem services provided by biodiversity in the city, and
- governance and management of biodiversity in the city

11. Specific changes in the CBI, resulting from the deliberations at the workshop, include:

(i) To standardise throughout the Index, proportions are used rather than percentages.

(ii) The scoring will be based on normalising the data provided by the cities. The statistical treatment of the cities' data would ensure a scientific basis for the scoring, fairness and objectivity. Statistical analysis will be applied to Indicators 2 (Connectivity), 3 (Native biodiversity in built-up areas), 9 (Proportion of protected areas), 11 (Regulation of water quantity), 12 (Climate regulation: carbon storage and cooling effect of vegetation), 15 (Budget allocated to biodiversity), and 16 (Number of biodiversity projects that are implemented by the city),

(iii) Indicator 2: Diversity of Ecosystems in the 21 November 2009 version

This indicator has been deleted in the present version as it was not likely that the number of ecosystems would change significantly over a medium time period, which is the reporting time-frame of the Index. However, information on the number of ecosystems in cities is still deem important and hence, it will be recorded under the Profile of the City of the Index.

(iv) Indicator 3: Fragmentation in the 21 November 2009 version

To emphasise the positive solution approach of the index, this indicator, re-numbered as Indicator 2, will measure the connectivity measures or ecological networks efforts to counter fragmentation.

(v) Indicators 5, 6, 7, 8 and 9: Number of native species in the 21 November 2009 version

The numbers of these indicators have been changed to 4, 5, 6, 7 and 8, respectively, in this current version, due to the deletion of the indicator on ecosystems. It was agreed that to be fair to all the cities (see paragraph 10a above), the indicators should measure change in species number rather than the absolute number of species. 2010 has been identified as the baseline year and cities would record the number of species of the mandatory taxonomic groups of vascular plants, birds and butterflies and two other taxonomic groups of the city's choice in the Profile of the City.

(vi) Indicator 12: Freshwater Services in the 21 November 2009 version

Many cities had problems with this indicator, hence the need to revise it. This indicator has been re-numbered as Indicator 11: Regulation of Quantity of Water. As a result of climate change, there is increased variability of the quantity of precipitation and impermeable surfaces will further aggravate the problem. Hence, this is an indicator that highlights the importance of permeable surfaces, in particular wetlands and natural ecosystems, that would help regulate and moderate the flow of water due to extreme climatic conditions.

(vii) Indicator 13: Carbon storage in the 21 November 2009 version

While cities were agreeable with the number of trees in principle, there were issues that were difficult to resolve, like species of trees, girth size of trees, trees planted by the city council or should it include trees in private land, etc. Re-numbered as Indicator 12, using area under tree canopy as a proportion of the total area of the city would be a good indirect measure of both the carbon storage and cooling effect of vegetation.

(viii) Indicator 14: Recreation and educational services as in the 21 November 2009 version

This indicator measuring number of visits per person per year was deleted as there were differences in the desired number for different types of areas. For example, the carrying capacity of nature reserves and national parks are lower than that of parks. Achieving high and increasing numbers of visitors is not a desired outcome for nature reserves and national parks but would be for horticultural parks with less natural ecosystems.

12. While it is recognised that there are some other indicators that could be included in the CBI, due to the urgency of completing the CBI for submission to COP10 in October 2010, minimum additions were made to the current version. Indicators that measure cities' efforts at restoring native biodiversity, ecosystem, ecosystem services, native biodiversity in landfill sites, green roofs and vertical greening initiatives, proximity to nature parks**,** and brownfield sites, etc., have been identified as important gaps that need to be addressed. Further revisions will include indicators that address these unrepresented areas.

13. The CBI is a dynamic process, evolving for the better continuously so as to be more useful, to allow it to be applicable to more cities and to be more scientifically robust. The strengths of the CBI are that:

(i) it is the only Index that focuses on biodiversity;
(ii) its coverage is diverse and comprehensive, incorporating indicators on biodiversity, ecosystem services, and good governance and management;
(iii) cities can do their own assessment, hence, building their capacity in biodiversity conservation and databases;
(iv) the scores are quantitative, hence, it is objective and it is possible to monitor change over time; and
(v) a diverse range of experts and stakeholders contribute to the design of the CBI.

14. The weaknesses of the CBI are that:

(i) it is difficult to select indicators that all cities have data on;
(ii) the scoring of some of the indicators is difficult due to the different ecological zones that cities are located in; and
(iii) indicators for ecosystem services are difficult to design as this a new field of study.

THIRD EXPERT WORKSHOP ON THE DEVELOPMENT OF THE CBI, 11 TO 13 OCTOBER 2011

15. The Third Expert Workshop on the Development of the City Biodiversity Index was held in Singapore from 11 to 13 October 2011. The workshop was organised by SCBD and Singapore, in close consultation with the members of the Global Partnership on Local and Subnational Action for Biodiversity (formerly known as GPCB).

16. The objectives of the workshop were to:

(a) Finalize the scoring of the indicators of the CBI;

(b) Discuss the roadmap of the contribution of the Singapore Index to the eleventh meeting of the Conference of Parties, including recommendations on its application and use for the appreciation of the Conference of the Parties at its eleventh meeting, under the agenda item on the engagement of other stakeholders, major groups and subnational authorities and through the Working Group on the Review of Implementation of the CBD, to be further developed at the World Cities Summit 2012 and beyond;

(c) Define ways to further expand the use of the Singapore Index on Cities' Biodiversity for cities (such as in planning and baseline setting) and for other levels of subnational government, and to provide for the governance of its standards and means of application;

(d) Discuss the documentation on cities' experiences on the application of the Singapore Index on Cities' Biodiversity; and

(e) Provide inputs to the first edition of the Cities and Biodiversity Outlook, in particular on the use of the Singapore Index on Cities' Biodiversity as an evaluation tool for the CBD Strategic Plan 2011-2020 at local and subnational levels.

17. A total of 26 technical experts on urban biodiversity conservation and planning as well as city representatives responsible for the implementation and/or management of biodiversity and urban projects and programmes attended the workshop.

18. The discussions and outcomes of the workshop were recorded in the Report of the Third Expert Workshop on the Development of the City Biodiversity Index, UNEP/CBD/EW-DCBI/3/2. The participants noted that only 13 cities provided data for the establishment of scoring ranges for the seven indicators. To ensure a robust statistical normalisation exercise, the participants proposed that data from at least 50 cities was required. Participants also reviewed all 23 indicators of the CBI and where necessary, suggested improvements to provide greater clarity in the data that were required.

19. The following issues were deliberated on in greater detail:

a) For accountability and standardization of reporting, it was agreed that the reporting of the implementation and scoring of the Singapore Index should be performed by the city officials. Universities, NGOs, consultants, etc. can carry out the data collection and analyses but the reporting will have to be channeled through the city officials. Cities can report on their results and experiences to the SCBD, National Parks Board of Singapore and ICLEI. The reports and case studies will be posted on the SCBD website or a newly created website to be announced soon.

b) The meeting agreed that the indicators should not be changed as experts from diverse disciplines had worked on them during the last two workshops and further inputs had been provided by cities.

c) In our efforts to maintain a high standard of scientific credibility, the methods for calculating the indicators should be reviewed stringently. Cities were requested to record in detail how the calculations were done and the assumptions made to ensure standardization of methodology. Extensive improvements were made in particular on Indicator 2: Connectivity measures or ecological networks to counter fragmentation.

d) Based on feedback from several cities, clearer definitions were set for many of the indicators, including Indicators, 1, 2, 4, 5, 6, 7, 8, 11, 15, 16 17. 18, and 23, which are captured in the updated Singapore index.

e) Seven of the indicators, i.e., Indicators 2, 3, 9, 11, 12, 15 and 16, required statistical normalization. Although preliminary attempts were made, cities are requested to give their data to NParks by February 2012 so that the statistical normalization exercise would be more stringent with a greater data sample size.

f) In recognition that some cities might not have all the data and to facilitate participation by a diverse range of cities, the implementation of the SI could be done stepwise, i.e., cities can initially start with indicators that they have data on. They can plan to collect data on other indicators progressively. Cities are also encouraged to share with us ideas on how they can improve on the application of the indicators to make them more relevant in the geographical context. For example, using tree canopy cover in Indicator 12 might not be suitable for cities in the desert or arid zones. Taking all these into consideration, cities are encouraged to apply all the 23 indicators.

g) It is emphasized that the Singapore Index is designed as a self-assessment tool. Hence, if it is used for comparative purposes, stratifications would have to be applied for more meaningful comparisons. Cities would have to be grouped according to geographical location, size, historical age, etc.

20. Mr. Andre Mader (ICLEI-Local Governments for Sustainability LAB Initiative) and Ms. Elisa Calcaterra (IUCN), both members of the Technical Task Force have left ICLEI and IUCN respectively. Ms. Shela Patrickson from ICLEI-Local Governments for Sustainability LAB Initiative attended the Third Expert Workshop and will replace Mr. Andre Mader in the Technical Task Force. The Technical Task Force now comprises six members: Dr. Nancy Holman (London School of Economics), Mr. Peter Werner (Institute of Housing and Environment, Darmstadt, Germany), Professor Thomas Elmqvist (Stockholm Resilience Centre), Ms. Shela Patrickson (ICLEI-Local Governments for Sustainability LAB Initiative), Mr. Oliver Hillel (SCBD) and Dr. Lena Chan (NParks)

*Third-Expert Workshop – After Note

21. It is observed during the collation of cities' results for Indicator 14 that the data and methodology does not fit the scoring range. The conventional approach is to take the total number of visits and divide it by the total number of students below 16 years old. This results in a number that may not fall within the scoring range. To get around this problem, Hamilton adopted a novel approach – Hamilton city authorities sampled schools with students of varying age groups (below 16) and ranking to obtain an estimated number that is representative of the student populous. We would also like to hear from other cities if they have alternative approaches in measuring Indicator 14.

GENERAL INFORMATION ON THE DRAFT USER'S MANUAL FOR THE CBI

21. The CBI comprises three parts:

(i) Profile of the City, where the city lists some background information relevant to biodiversity conservation, supplementing the data captured in the indicators.

(ii) Indicators to be evaluated by the city.

(iii) Calculation of the Index.

22. The table in Part II of the CBI (page 16 and following) contains explanation and guidelines on the 23 indicators:

(i) the rationale for selection of the indicator,

(ii) how to calculate the indicator,

(iii) where to get data for the calculations, and

(iv) basis for the scoring.

23. The method of scoring is quantitative in nature. To ensure that the scoring is unbiased and fair to a broad spectrum of cities of different characteristics over a wide geographical range, statistical analysis will be applied to the data provided by the cities. A minimum of data sets from 20 cities is required to ensure a sample size suitable for statistical analysis.

24. During the preparation of the User's Manual, more appropriate measurements were proposed. A maximum score of four is allocated for each indicator, and currently with 23 indicators, the maximum score of the CBI is 92.

25. The application and reporting of the index is to be carried out by the official city authorities. In the course of applying the index, city authorities are encouraged to engage and consult other stakeholders such as universities and NGOs.

UPDATES ON THE TEST-BEDDING OF THE CBI

26. As of 6 September 2010, the table below indicates the cities which have test-bedded the November 2009 of the CBI and those which are in the various stages of test-bedding. **A map showing all the cities that have test-bedded the CBI and the ecological biomes will be on a website which will be announced soon**

Cities which have test-bedded and provided their preliminary scores* for the CBI	**Cities which have agreed and are in various stages of test-bedding**
1. Brazil: Curitiba 2. Belgium: Brussels Capital Region 3. Canada: Edmonton 4. Estonia: Tallinn 5. France: Montpellier 6. Germany: Frankfurt 7. Indonesia: Bandung 8. Japan: Nagoya 9. New Zealand: Waitakere City 10. Singapore 11. Thailand: Bangkok 12. Thailand: Chiang Mai 13. Thailand: Krabi 14. Thailand: Phuket 15. United Kingdom: London * *Some of the cities did not score on all the indicators due to lack of information*	1. Australia: Joondalup 2. Cambodia: Phnom Penh 3. Cambodia: Siem Reap 4. Canada: Montreal, Ottawa 5. European cities participating in the European Capitals of Biodiversity Competition (from five countries – France, Germany, Hungary, Spain and Slovakia) 6. France: Paris 7. Indonesia: Padang 8. Indonesia: Pekanbaru 9. Lao PDR: Vientiane 10. Lao PDR: Xayaboury 11. Malaysia: Sibu 12. Malaysia: Kuantan 13. Philippines: Iloilo City 14. Philippines: Puerto Princesa City 15. Philippines: Quezon City 16. Spain: Ourense 17. USA: Montpelier 18. USA: Kings County 19. Viet Nam: Danang 20. Viet Nam: Hanoi

MILESTONES

27. The following highlights the key milestones for the CBI leading up to its endorsement at COP10 in Nagoya, Japan in October 2010, as part of the Plan of Action on Subnational Governments, Cities and Other Local Authorities for Biodiversity.

- November 2009 - Posting of the draft User's Manual for the CBI on the CBD website for feedback from cities, academics, etc.
- 6-7 January 2010 - Discussion of the CBI at the Second Curitiba Meeting on Cities and Biodiversity, Curitiba, Brazil
- 1-3 July 2010 - Second Expert Workshop on the Development of the CBI – to finalise the indicators of the CBI
- 18-29 October 2010
  - Discussion on the CBI at the City Biodiversity Summit, Nagoya (24-26 October 2010)
  - Tabling of the CBI as a self-evaluation tool for post-2010 monitoring purposes in the Draft Plan of Action on Cities, Local Authorities and Biodiversity 2011-2020 as part of a draft COP decision under agenda item 4.9 on "Cooperation with other conventions and international rganizations and initiatives, engagement of stakeholders, including business and biodiversity, cities and biodiversity, and South/South cooperation".

28. Cities that are interested to test-bed the CBI can provide their feedback and queries to Dr. Lena Chan (*Lena_CHAN@nparks.gov.sg*) or Ms Wendy Yap (*wendy_yap@nparks.gov.sg*), and they will circulate them to the Task Force. Universities, researchers, academics, individuals, etc. who have invaluable biodiversity data that are relevant to the CBI are invited to share their data with us. We will facilitate the channeling of the biodiversity data to the relevant city officials.

CITY BIODIVERSITY INDEX

PART I: PROFILE OF THE CITY

As the CBI focuses on only a few parameters, it is important that other information not captured in the Index be given so as to give a more holistic picture of the native biodiversity that can be found in the city. The profile of the city will include important general information on the city, and in particular details of biodiversity data, so as to give a more comprehensive background on the city and to place the city's evaluation for the Index in the proper perspective. The data and information including images of native flora, fauna and ecosystems in cities should be included in this section which will be used for the computation of the indicators. The information could include:

(i) Location (geographical coordinates (latitudes and longitudes); climate (temperate or tropical); temperature (range and average); rainfall/ precipitation (range and average); other relevant information)

(ii) Size (area and include google map or satellite image, and define city boundaries; number of administrative units in cities or local authorities)

(iii) Population (including total population and population density of the city; the population of the region could also be included if appropriate, and for the purpose of placing it in the regional context)

(iv) Economic parameters (Gross Domestic Product (GDP), Gross National Product (GNP), per capita income, key economic activities, drivers and pressures on biodiversity)

(v) Physical features of the city (geography, altitude of the city**,** area of impermeable surface, information on brownfield sites, etc.)

(vi) Biodiversity features and characteristics such as:

- Ecosystems found in the city
  - Mandatory: Cities to list ecosystems present in the first year in which they participate in the Index as a baseline. The Habitat Authority File (http://intranet.iucn.org/webfiles/doc/SSC/RedList/AuthorityF/habitats.rtf) will be used as the reference list for cities to select the ecosystems that occur within their city boundaries.
  - Optional: Maps which show the location of ecosystems, if available

- Species found in the city (data will be used for the calculation of Indicators 3,4,5,6,7,8 and 10)
  - Mandatory species: Number of species of vascular plants, birds, butterflies and 2 other taxonomic groups of the city's choice. The data from the first year of participating in the Index will form the baseline for future monitoring.

- Optional species: Cities can also list the total number of species for other taxonomic groups if they have the data. This would give a more complete picture of the species diversity in the cities.

- Quantitative data on populations of key biodiversity indicators. These include quantitative data on major taxonomic groups which are used to determine the conservation status of the species.

- Relevant qualitative biodiversity data. These include write-ups on the natural history of the cities, ecological rehabilitation and restoration initiatives, special biodiversity features, re-introduction of native species, etc.

(vii) Administration of biodiversity (Relevant information include agencies and departments responsible for biodiversity; how natural areas are protected (through national parks, nature reserves, forest reserves, secured areas, parks, etc.) with information like what are the categories, where are the protected areas, how large are they, what are the aims of conserving these areas and functions of these areas etc.)

(viii) Links to relevant websites including the city's website, environmental or biodiversity-specific websites, websites of agencies responsible for biodiversity

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- PART II: INDICATORS OF THE CITY BIODIVERSITY INDEX

CBI	INDICATORS	VARIABLES	SCORE
Native Biodiversity	**INDICATOR 1: PROPORTION OF NATURAL AREAS IN CITY**		
	RATIONALE FOR SELECTION OF INDICATOR Natural ecosystems harbour more species than disturbed or man-made landscapes, hence, the higher the percentage of natural areas compared to that of the total city area gives an indication of the biodiversity richness. However, a city by definition has a high proportion of modified land area and this is factored into the scoring. Taking into account the inherent differences in the richness in biodiversity of tropical vs temperate regions, new vs mature cities, large vs small cities, developing vs developed countries, it was agreed at the Third Expert Workshop on the Development of the City Biodiversity Index that the working definition of "Natural Areas" is as follows: Natural areas comprise predominantly native species and natural ecosystems, which are not, or no longer, or only slightly influenced by human actions, except where such action is intended to conserve, enhance or restore native biodiversity**.** Natural ecosystems are defined as all areas that are natural and not highly disturbed or completely man-made landscapes. Some examples of natural ecosystems are forests, mangroves, freshwater swamps, natural grasslands, streams, lakes, etc. Parks, golf courses, roadside plantings are not considered as natural. However, natural ecosystems with dominant native species within parks can be included in the computation. The definition also takes into consideration "restored ecosystems" and "naturalised areas" in order to recognise efforts made by cities to increase the Natural Areas of their city. Restoration helps increase natural areas in the city and cities are encouraged to restore their impacted ecosystems.	HOW TO CALCULATE INDICATOR (Total area of natural areas, restored and naturalised areas) ÷ (Total area of city) × 100% WHERE TO GET DATA FOR CALCULATIONS Possible sources of data on natural areas include government agencies in charge of biodiversity, city municipalities, urban planning agencies, biodiversity centres, nature groups, universities, publications, etc. Google maps and satellite images also provide information for calculating this indicator.	BASIS OF SCORING Based on the assumption that, by definition, a city comprises mainly man-made landscapes, the maximum score will be accorded to cities with natural areas occupying more than 20% of the total city area 0 point : < 1% 1 point: 1% – 6% 2 points: 7% – 13% 3 points : 14% – 20% 4 points : > 20%

CBI	INDICATORS	VARIABLES	SCORE
Native Biodiversity	**INDICATOR 2: CONNECTIVITY MEASURES OR ECOLOGICAL NETWORKS TO COUNTER FRAGMENTATION**		
	RATIONALE FOR SELECTION OF INDICATOR Fragmentation of natural areas is one of the main threats to the sustainability of biodiversity in a city. Hence, it has been selected as an indicator to chart possible future trends. However, it is not easy to measure fragmentation. Some of the ways to measure fragmentation include mean patch size or distance between patches, etc. It is recognised that the fragmentation of natural areas affects different species differently. For example, a road may not be a barrier for birds but it can seriously fragment a population of arboreal primates. A strip of urbanisation may not affect the dispersal of wind-pollinated plants but a plant that depends on small mammals for dispersal will be adversely affected. While these differences have been noted, considered and deliberated upon, a pragmatic approach towards the calculation of this indicator is adopted, as reflected in the formula given in the next column. Furthermore, to encourage positive action to increase connectivity or reduce barriers to connectivity, it would be more meaningful to measure connectivity rather than fragmented plots. This indicator score can be improved when more of the fragments are connected.	HOW TO CALCULATE INDICATOR $$IND2 = \frac{1}{A_{\text{total}}}\left(A_1^2 + A_2^2 + A_3^2 + \ldots + A_n^2\right)$$ Where: • n is the total number of connected natural areas • A_{total} is the total area of all natural areas • A_1 to A_n are areas that are distinct from each other (i.e. not connected) A_1 to A_n may consist of areas that are the sum of two or more smaller patches which are connected. In general, patches are considered as connected if they are less than 100m apart. However, exceptions to the above rule includes anthropogenic barriers such as: • Roads (15m or more in width; or are smaller but have a high traffic volume of more than 5000 cars per day) • Rivers that are strongly modified and other artificial barriers such as heavily concretised canals and heavily built up areas • Any other artificial structures that the city would consider as a barrier Details and illustrations of how this indicator may be calculated are included in ANNEX B. WHERE TO GET DATA FOR CALCULATIONS Satellite images can be used in the computation of this indicator.	BASIS OF SCORING To ensure a more realistic and unbiased scoring range, cities are requested to send in their actual data so that statistical analysis can be applied to the data using the mean as the reference for '2-point' score. *[scoring range to be determined]* Cities are requested to submit a list of all the natural areas within their city accompanied by a map (ideally in GIS format) indicating their respective locations.

CBI	INDICATORS	VARIABLES	SCORE
Native Biodiversity	**INDICATOR 3: NATIVE BIODIVERSITY IN BUILT-UP AREAS (BIRD SPECIES)**		
	RATIONALE FOR SELECTION OF INDICATOR It is acknowledged that cities comprise largely of built-up areas and brownfield sites with anthropogenic green spaces and minimal natural features. However, it should be recognised that built-up areas and brownfield sites do harbour biodiversity, e.g., birds like swallows and swiftlets nest under roofs of buildings, plants grow on buildings, butterflies flutter around sun-lit shrubs and grassy patches, dragonflies dart above water features, etc. Some built-up areas and brownfield sites have more biodiversity than others. By enhancing certain features in such areas, the biodiversity could improve. Hence, native biodiversity in built-up areas and brownfield sites should be an indicator. Most cities have data on bird species. Hence, this taxonomic group will be used as an indicator. The number of native bird species in built-up areas and anthropogenic green spaces is inevitably lower than that found in sites with natural ecosystems; however implementing appropriate measures such as planting fruit trees, shrub with berries, etc. may attract birds into built-up areas of the city.	HOW TO CALCULATE INDICATOR Number of native bird species in built-up areas where built-up areas include impermeable surfaces like buildings, roads, drainage channels, etc., and anthropogenic green spaces like roof gardens, roadside planting, golf courses, private gardens, cemeteries, lawns, urban parks, etc. Areas that are counted as natural areas in Indicator 1 should not be included in this indicator. WHERE TO GET DATA FOR CALCULATIONS City councils, universities, NGOs, etc.	BASIS OF SCORING To obtain a more realistic and unbiased scoring range, cities are requested to send in their actual data for normalisation, taking the mean of the bird species found in built-up areas of cities which have tested the index to be used as reference for the '2- point' score. *[scoring range to be determined]*

CBI	INDICATORS	VARIABLES	SCORE
Native Biodiversity	**INDICATORS 4 - 8: CHANGE IN NUMBER OF NATIVE SPECIES**		
	RATIONALE FOR SELECTION OF INDICATOR As this is an index focussing on biodiversity in cities, it is essential that the native flora and fauna diversity be incorporated as indicators. Three key taxonomic groups that are most surveyed worldwide, i.e., plants, birds and butterflies, have been selected as "core indicators". To ensure fairness and objectivity in the index, cities can select 2 other taxonomic groups that would reflect their best biodiversity. To ensure that these 5 indicators on species are unbiased against any city based on its geographical location, ecological history, size, land-use, etc., it was decided that • All cities and local authorities are requested to list the number of native species of a) vascular plants, b) birds, and c) butterflies, d) at least 2 other taxonomic groups, and e) any other taxonomic groups that they have data on, in Part I: Profile of the City • The indicators will measure the change in number of species over time rather than the absolute number of the species • The year 2010 will be taken as the baseline year for the species count. The net change in species numbers (increase in number of species due to re-introduction or restoration efforts minus the number of species that went extinct) will be incorporated in the 2012 calculations of the CBI. Conducting more surveys on the target groups which will result in the finding of and reintroducing 'extinct' native species would help to increase the number of extant native species.	HOW TO CALCULATE INDICATORS The total number of native species is used for Indicators 4 to 8. The 3 core groups are: - Indicator 4 : vascular plants - Indicator 5 : birds - Indicator 6 : butterflies These groups have been selected as data are most easily available and to enable some common comparison. Cities can select any 2 other taxonomic groups for Indicators 7 and 8 (e.g., bryophytes, fungi, amphibians, reptiles, freshwater fish, molluscs, dragonflies, carabid beetles, spiders, hard corals, marine fish, seagrasses, sponges, etc.) The above data for 2010 would be recorded in Part I: Profile of the City as the baseline. Net change in species from the previous survey to the most recent survey is calculated as: Total increase in number of species (as a result of re-introduction, rediscovery, new species found, etc.) minus number of species that have gone extinct WHERE TO GET DATA FOR CALCULATIONS Possible sources of data include government agencies in charge of biodiversity, city municipalities, urban planning agencies, biodiversity centres, nature groups, universities, publications, etc.	BASIS OF SCORING Data listed in Part I: Profile of the City will be used to measure change in species diversity every 3 years. Cities first application will be considered as the baseline information for all subsequent monitoring, In their second application of the index, cities will calculate the net change in species for the respective taxonomic groups. The scoring range below is based on the acceptance that it is not easy to recover or re-introduce species successfully over a short period of time. However, species recovery, re-introduction and restoration efforts must be given due recognition. In recognition of the mission of the Aichi Biodiversity Targets the scoring below indicates that 1 point will be accorded if a city does not lose any species in the target group. 1 point: No loss of species 2 points: 1 species increase 3 points: 2 species increase 4 points: 3 species or more increase

CBI	INDICATORS	VARIABLES	SCORE
Native Biodiversity	**INDICATOR 9: PROPORTION OF PROTECTED NATURAL AREAS**		
	RATIONALE FOR SELECTION OF INDICATOR Protected or secured natural areas indicate the city's commitment to biodiversity conservation. Hence, the proportion of protected or secured natural areas is an important indicator. The definition of protected natural areas should be broadened to include legally protected, formally secured areas, and other administratively protected areas, as different cities have different terminologies and means for protecting their natural areas.	HOW TO CALCULATE INDICATOR (Area of protected or secured natural areas) ÷ (Total area of the city) × 100% WHERE TO GET DATA FOR CALCULATIONS Possible sources of data include government agencies in charge of biodiversity, city municipalities, urban planning agencies, biodiversity centres, nature groups, universities, publications, etc.	BASIS OF SCORING To ensure a more realistic and unbiased scoring range, cities are requested to send in their actual data so that statistical analysis can be applied to the data using the mean as the reference for '2-point' score. *[scoring range to be determined]*
CBI	**INDICATORS**	**VARIABLES**	**SCORE**
Native Biodiversity	**INDICATOR 10: PROPORTION OF INVASIVE ALIEN SPECIES (AS OPPOSED TO NATIVE SPECIES)**		
	RATIONALE FOR SELECTION OF INDICATOR Invasive alien species out-compete native species and, thus, threaten the survival of native species and the integrity of ecosystems. As cities are very open to influx of alien species, this indicator measures the status of this threat. The definition of alien invasive species adopted follows that accepted by the SCBD, i.e.: An alien species whose introduction and/ or spread threaten biological diversity (For the purposes of the present guiding principles, the term "invasive alien species" shall be deemed the same as "alien invasive species" in decision V/8 of the Conference of the Parties to the Convention on Biological Diversity). It is inevitable in cities, which are open to external influences, to have alien species. Alien species which are not invasive or detrimental to native species are not considered in this indicator. In fact in many cities, exotic or alien species enhance the diversity. Cities can decide on the taxonomic groups which are most problematic for their city or where most data are available.	HOW TO CALCULATE INDICATOR To ensure that the comparison of invasive alien species with that of native species is meaningful, it would have to be a comparison of identical taxonomic groups. (Number of invasive alien species) ÷ (Number of native species) × 100% WHERE TO GET DATA FOR CALCULATIONS Possible sources of data include government agencies in charge of biodiversity, city municipalities, urban planning agencies, biodiversity centres, nature groups, universities, publications, etc.	BASIS OF SCORING The scoring range is based on the premise that the more invasive alien species that are in the city; the more destructive impact will be to the native species. 0 point : > 30% 1 point : 21%-30% 2 points : 11%-20% 3 points : 1%-10% 4 points : < 1%

CBI	INDICATORS	VARIABLES	SCORE
Ecosystem Services	**INDICATOR 11: REGULATION OF QUANTITY OF WATER**		
	RATIONALE FOR SELECTION OF INDICATOR Climate change is in many places predicted to result in increased variability in precipitation which in urban landscapes may translate into high peaks in water-flow and damage to construction, business and transport. Vegetation has a significant effect in reducing the rate of flow of water through the urban landscape, e.g. through presence of forest, parks, lawns, roadside greenery, streams, rivers, waterbodies, etc.	HOW TO CALCULATE INDICATOR Proportion of all permeable areas (including areas identified in Indicator 1 plus other parks, roadside greenery, green roofs, private gardens, streams, rivers, etc.) to total terrestrial area of city (excluding marine areas and artificial permeable surfaces, if applicable) (Total permeable area) ÷ (Total terrestrial area of the city) × 100% WHERE TO GET DATA FOR CALCULATIONS Possible sources of data include government environmental agencies, city municipalities, urban planning, water and land agencies, satellite images, etc.	BASIS OF SCORING To ensure a more realistic and unbiased scoring range, cities are requested to send in their actual data so that statistical analysis can be applied to the data using the mean as the reference for '2-point' score. ***[scoring range to be determined]***
Ecosystem Services	**INDICATORS**	**VARIABLES**	**SCORE**
	INDICATOR 12: CLIMATE REGULATION: CARBON STORAGE AND COOLING EFFECT OF VEGETATION		
	RATIONALE FOR SELECTION OF INDICATOR Two important aspects of climate regulation services are carbon storage and cooling effects provided by vegetation, in particular tree canopy cover. Climate regulation services are affected by many factors, including the size of trees, the different characteristics of tree species, and other variables, etc. With regards to carbon storage, plants capture carbon dioxide during photosynthesis, hence, capturing carbon that is emitted by anthropogenic activities. Canopy cover of trees, which includes those that are naturally occurring and planted in a city, is accepted here as an indirect measure of the carbon sequestration and storage services. Plants, through shading, evapotranspiration, and decreasing the proportion of reflective surfaces, reduce the ambient heat in the air and the surface temperature in the urban landscape. As a general rule, a 10% increase in vegetation cover reduces the temperature by about 3 degrees, hence, cooling the ambient temperatures. The extent of tree canopy cover can also act as a proxy measure for filtering of air and numerous other biodiversity benefits.Planting of native trees to increase the canopy cover is encouraged. This indicator is optional for cities in the desert or arid zones or other ecological zones where extensive canopy cover in the city may not be feasible.	HOW TO CALCULATE INDICATOR Carbon storage and cooling effect of vegetation (Tree canopy cover) ÷ (Total terrestrial area of the city) × 100% WHERE TO GET DATA FOR CALCULATIONS City councils and satellite images	BASIS OF SCORING To ensure a more realistic and unbiased scoring range, cities are requested to send in their actual data so that statistical analysis can be applied to the data using the mean as the reference for '2-point' score. *[scoring range to be determined]*

CBI	INDICATORS	VARIABLES	SCORE
Ecosystem Services	**INDICATORS 13 –14: RECREATIONAL AND EDUCATIONAL SERVICES**		
	RATIONALE FOR SELECTION OF INDICATOR Biodiversity provides invaluable recreational, spiritual, cultural and educational services. It is essential for physical and psychological health. **Oliver to provide: Healthy parks healthy people – savings in health costs.**	HOW TO CALCULATE INDICATOR Indicator 13: (Area of parks with natural areas and protected or secured natural areas)*/ 1000 persons *Some cities refer to this as accessible green spaces Indicator 14: Number of formal educational visits per child below 16 years to parks with natural areas or protected or secured natural areas per year WHERE TO GET DATA FOR CALCULATIONS Indicator 13: City councils Indicator 14: School records	BASIS OF SCORING Indicator 13: 0 point : < 0.1 ha/ 1000 persons 1 point : 0.1 – 0.3 ha/ 1000 persons 2 points : 0.4 – 0.6 ha/ 1000 persons 3 points : 0.7 – 0.9 ha/ 1000 persons 4 points : > 0.9 ha/ 1000 persons Indicator 14: 0 point : 0 formal educational visit/ year 1 point : 1 formal educational visit/ year 2 points: 2 formal educational visits/year 3 points: 3 formal educational visits/year 4 points: > 3 formal educational visits/ year

CBI	INDICATORS	VARIABLES	SCORE
Governance and Management	**INDICATOR 15: BUDGET ALLOCATED TO BIODIVERSITY**		
	RATIONALE FOR SELECTION OF INDICATOR This indicator evaluates what programmes and projects are put in place to ensure the maintenance and enhancement of biodiversity in cities. The relative amount spent on biodiversity related administration by a city can be seen as a representation of the city's commitment towards environmental stewardship. It is recognised that there are numerous other factors affecting the amount allocated towards biodiversity, but in general the greater the proportion of the total city's budget allocated, the greater the level of commitment by the city. In cities where the functions of maintaining greenery and biodiversity conservation are also assigned to the private sector or government-linked corporations, the budget for these government-linked companies may also be included in the calculations.	HOW TO CALCULATE INDICATOR (Amount spent on biodiversity related administration) ÷ (Total budget of city) × 100% Computation should include the city's or municipality's manpower budget as well as its operational and biodiversity related project expenditure. The calculation may also include the figures of government linked corporations that have a component spent on biodiversity, where such figures are available. WHERE TO GET DATA FOR CALCULATIONS Possible sources of data include government agencies responsible for biodiversity conservation and finance departments. For cities where the budget of government-linked companies are included, annual reports of those companies can provide relevant data.	BASIS OF SCORING To ensure a more realistic and unbiased scoring range, cities are requested to send in their actual data so that statistical analysis can be applied to the data using the mean as the reference for '2-point' score. ***[scoring range to be determined]***

CBI	INDICATORS	VARIABLES	SCORE
Governance and Management	**INDICATOR 16: NUMBER OF BIODIVERSITY PROJECTS IMPLEMENTED BY THE CITY ANNUALLY**		
	RATIONALE FOR SELECTION OF INDICATOR This indicator measures the number of biodiversity related projects and programmes that the city authorities are involved in, either as the main player or in partnerships with other entities where the city is a key collaborator. Programmes and projects are not limited to the conservation of protected areas but could include those pertaining to species conservation (e.g. plants, birds and butterflies), species recovery, biodiversity surveys, biodiversity enhancement projects, restoration projects, procurement of green services, etc. For a project or a programme to be included in this indicator, biodiversity must be an important consideration in the stated objectives. A programme designed to conserve species that are non-native to the city, but threatened elsewhere (e.g. zoo species conservation projects) can be considered as well.	HOW TO CALCULATE INDICATOR Number of programmes and projects that are being implemented by the city authorities, possibly in partnership with private sector, NGOs, etc. per year In addition to submitting the total number of projects and programmes carried out, cities are encouraged to provide a listing of the projects and to categorise the list into projects that are: 1. Biodiversity related 2. Ecosystems services related WHERE TO GET DATA FOR CALCULATIONS Possible sources of data include city authorities, private corporations and NGOs that conduct such activities etc.	BASIS OF SCORING To ensure a more realistic and unbiased scoring range, cities are requested to send in their actual data so that statistical analysis can be applied to the data using the mean as the reference for '2-point' score. *[scoring range to be determined]*

CBI	INDICATORS	VARIABLES	SCORE
Governance and Management	**INDICATOR 17: POLICY, RULES AND REGULATIONS – EXISTENCE OF LOCAL BIODIVERSITY STRATEGY AND ACTION PLAN**		
	RATIONALE FOR SELECTION OF INDICATOR To ensure that there is good governance, sound policies must be formulated. To facilitate the implementation of biodiversity management policies, rules and regulations must be put in place. This section evaluates the existence of biodiversity-relevant policies, rules and regulations, in particular whether they are aligned with the national agenda and CBD's initiatives, like the National Biodiversity Strategy and Action Plan (NBSAP) and/or the correspondent sub-national strategies. Some of the CBD initiatives include plant conservation, forest biodiversity, global taxonomy initiative, invasive species programme, marine biodiversity conservation, protected areas, etc. The initiatives might not be termed LBSAP. As long as the city can justify that a similar plan exists.	HOW TO CALCULATE INDICATOR Status of Local Biodiversity Strategy and Action Plan (LBSAP, or equivalent plan); number of associated CBD initiatives WHERE TO GET DATA FOR CALCULATIONS Possible sources of data include city councils, CBD national focal points, ICLEI-Local Governments for Sustainability LAB Initiative, United Nations University and IUCN, CBD website and publications	BASIS OF SCORING To ensure that biodiversity is conserved in a city, it is advisable to draw up a LBSAP (or any equivalent plan). This needs to be aligned with the NBSAP so that biodiversity conservation efforts are synchronised and synergised. 0 point : No LBSAP* 1 point : LBSAP not aligned with NBSAP 2 points : LBSAP incorporates elements of NBSAP, but does not include any CBD initiatives** 3 points : LBSAP incorporates elements of NBSAP, and includes 1 to 3 CBD initiatives 4 points : LBSAP incorporates elements of NBSAP, and includes 4 or more CBD initiatives * LBSAP or equivalent ** The thematic programmes of work and cross-cutting issues of the convention are listed in http://www.cbd.int/programmes/. Please refer to attached document for a brief explanation on CBD's relevant thematic areas such as ecosystem approach, etc. to cities and local authorities. The CBD Strategic Plan (2011-2020) and the Aichi Biodiversity Targets (http://www.cbd.int/sp/targets/) can also be used as a reference framework.

CBI	INDICATORS	VARIABLES	SCORE
Governance and Management	**INDICATORS 18 – 19: INSTITUTIONAL CAPACITY**		
	RATIONALE FOR SELECTION OF INDICATOR Institutions are necessary for the effective implementation of projects and programmes. Hence, the existence of biodiversity-focussed and biodiversity-related institutions will greatly enhance biodiversity conservation in a city. Some of the essential institutions include a well-managed biodiversity centre, herbarium, zoological garden or museum, botanical garden, insectarium, etc. It is more important to measure whether the functions of these institutions exist rather than the physical existence of these institutions. Hence, if a herbarium is situated in a botanical garden, then two functions exist in the city under one institution. Many biodiversity issues are cross-sectoral and, hence, involve inter-agency efforts. The evaluation of inter-agency coordination is an important indicator of the success of biodiversity conservation, more so in a city where it is so compact. This indicator promotes mainstreaming of biodiversity.	HOW TO CALCULATE INDICATOR **Indicator 18:** Number of essential biodiversity-related functions* that the city uses ** The functions could include the following: biodiversity centre, botanical garden, herbarium, zoological garden or museum, insectarium, etc.* **Indicator 19:** Number of city or local government agencies involved in inter-agency cooperation pertaining to biodiversity matters WHERE TO GET DATA FOR CALCULATIONS City councils	BASIS OF SCORING **Indicator 18:** 1 point : 1 function 2 points : 2 functions 3 points : 3 functions 4 points : > 3 functions **Indicator 19:** 0 point : 1 or 2 agencies* cooperate on biodiversity matters 1 point : 3 agencies cooperate on biodiversity matters 2 points : 4 agencies cooperate on biodiversity matters 3 points : 5 agencies cooperate on biodiversity matters 4 points : More than 5 agencies cooperate on biodiversity matters ** Agencies could include department or authorities responsible for biodiversity, planning, water, transport, development, finance, infrastructure, etc.*

CBI	INDICATORS	VARIABLES	SCORE
Governance and Management	**INDICATORS 20 – 21: PARTICIPATION AND PARTNERSHIP**		
	RATIONALE FOR SELECTION OF INDICATOR Indicator 20 evaluates the existence and the state of formal or informal public consultation process pertaining to biodiversity-related matters. Indicator 21 measures the extent of informal and/or formal partnerships, or collaboration with other entities. As it is impossible for any single agency to carry out all the activities, responsibilities, projects and programmes that have biodiversity implications, hence, it is inevitable that engagement of all levels of the population must be facilitated. These include the city officials in various departments, other spheres of government, the public, private sector, NGOs, etc. Such partnerships should have substantial and long-term involvement on the part of the city officials, such as programmes like Payments for Ecosystem Services (PES).	HOW TO CALCULATE INDICATOR **Indicator 20:** Existence and state of formal or informal public consultation process pertaining to biodiversity-related matters **Indicator 21:** Number of agencies/ private companies/ NGOs/ academic institutions/ international organisations with which the city is partnering in biodiversity activities, projects and programmes Inter-agency cooperations listed in IND19 should not be listed here again. WHERE TO GET DATA FOR CALCULATIONS City councils	BASIS OF SCORING **Indicator 20:** 0 point : No routine formal or informal process 1 point : Formal or informal process being considered as part of the routine process 2 points : Formal or informal process being planned as part of the routine process 3 points : Formal or informal process in the process of being implemented as part of the routine process 4 points : Formal or informal process exists as part of the routine process **Indicator 21:** 0 point : No formal/ informal partnerships 1 point : City in partnership with 1-6 other national or sub-national agencies/ private company/ NGO/ academic institutions/ international organisations 2 points : City in partnership with 7-12 other national or sub-national agencies/ private companies/ NGOs/ academic institutions/ international organisations 3 points : City in partnership with 13-19 other national or sub-national agencies/ private companies/ NGOs/ academic institutions/ international organisations 4 points : City in partnership with 20 or more other national or sub-national agencies/ private companies/ NGOs/ academic institutions/ international organisations

CBI	INDICATORS	VARIABLES	SCORE
Governance and Management	**INDICATORS 22 - 23: EDUCATION AND AWARENESS**		
	RATIONALE FOR SELECTION OF INDICATOR Education can be divided into two categories, formal through the school curriculum or informal. Two aspects will be evaluated, i.e., formal education and public awareness. While Indicator 14 gives an indication of school children's use of recreational services provided by ecosystems, Indicators 22 and 23 highlight: (i) whether biodiversity is included in the school curriculum; and (ii) the number of outreach or public awareness events are held per year? For Indicator 22, most cities have no jurisdiction over school curricula. The incorporation of this indicator creates the opportunity for city officials to liaise with education officers so that biodiversity courses are taught at pre-school, primary, secondary and tertiary levels. For Indicator 23, the event should either be organised entirely by the city authorities, or there should be a heavy involvement of the authorities before the event can be considered for inclusion in the indicator. Events that just take place within the city are not considered, as they are not representative of the governance exerted by the city authorities.	HOW TO CALCULATE INDICATOR Indicator 22: Is biodiversity or nature awareness ~~is~~ included in the school curriculum (e.g. biology, geography, etc.) Indicator 23: Number of outreach or public awareness events held in the city per year WHERE TO GET DATA FOR CALCULATIONS Education department, city councils, NGOs	BASIS OF SCORING Indicator 22: 0 point : Biodiversity or elements of it are not covered in the school curriculum 1 point : Biodiversity or elements of it are being considered for inclusion in the school curriculum 2 points : Biodiversity or elements of it are being planned for inclusion in the school curriculum 3 points : Biodiversity or elements of it are in the process of being implemented in the school curriculum 4 points : Biodiversity or elements of it are included in the school curriculum Indicator 23: 0 point : 0 outreach events/ year 1 point : 1 - 59 outreach events / year 2 points : 60 -149 outreach events / year 3 points : 150-300 outreach events / year 4 points : > 300 outreach events / year Cities are requested to include a full list of the events included in the calculation for Indicator 23, as well as information on how many people attended the event or were targeted where available.

PART III: CALCULATION OF THE INDEX

INDICATOR	CALCULATION	SOURCE	SCORE
Native Biodiversity in the City			
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
Ecosystem Services Provided by Biodiversity in the City			
11			
12			
13			
14			
Governance and Management of Biodiversity in the City			
15			
16			
17			
18			
19			
20			
21			
22			
23			

ANNEX A

Brief Explanation on CBD's Relevant Thematic Areas to Cities and Local Authorities

The thematic programmes of work and cross-cutting issues of the Convention (see http://www.cbd.int/programmes/ for a complete list) apply, in general, both to the national as to the sub-national level. For this reason, local authorities developing and/or reviewing their biodiversity strategies and action plans can be guided by all of them. However, for ease of reference, below is a list of the most recent (COP 9) decisions of the CBD with a direct bearing on local authorities:

Agriculture: decision IX/1 on Agricultural Biodiversity states, in its *consideration*, that Parties recognize the challenge to secure sustainable food production globally and increase agricultural production for local needs, as an important step to eradicate poverty and sustain livelihoods. Urban agriculture has increased in economic and social importance, and land-use planning in the agricultural expansion frontier is a key mandate for local authorities. Local authorities are invited to implement, as appropriate, projects and activities on urban agriculture. The CBD Food and Nutrition initiative (see http://www.cbd.int/agro/food-nutrition/) also relates to the work of local governments.

Ecosystem approach - This is the conceptual framework for the Convention, and in practice it means the full involvement of local authorities (see http://www.cbd.int/ecosystem/). Decision IX/7 on the Ecosystem Approach mentions, in item (c), that although the ecosystem approach is not being applied systematically to reduce the rate of biodiversity loss, many examples of successful application at the local scale are available and should be widely promoted and communicated (inter alia in National Reports). Most of these examples can be considered as positive outcomes for both biodiversity and human well-being. Local authorities are invited to report, to their National Governments, on such cases.

Climate change, desertification and biodiversity: Local authorities also retain critical mandates on the links between biodiversity and the other 2 Rio Conventions (climate change and desertification). Decision IX/16 notes that efforts at the national and local levels are of high importance to the achievement of synergies between activities addressing biodiversity, combating desertification/land degradation and climate change, and *invites* Parties and other Governments, where appropriate and based on national circumstances, to implement the activities contained in the indicative list in the annex to the decision – the same applies to local authorities.

Listing and identifying species - decision VIII/3 (paragraph 11 e) on the Global Taxonomy Initiative invites Parties to undertake, as part of the Global Initiative on Communication, Education and Public Awareness programme and in collaboration with relevant partners, activities demonstrating the importance of taxonomy for the general public, including information on products, lessons learned, and accomplishments of taxonomy-related projects, and activities encouraging public participation, recognising the importance of volunteer naturalists and local and indigenous people as a source of expertise; the request applies as well to local authorities in particular relating to the first component of the City Biodiversity Index (urban biodiversity assessments).

Local networks of protected areas: sub-national governments can contribute substantially to any 2011-2020 targets of the CBD on protected areas. The national protected areas network of Brazil, for instance, has over 700 municipal Parks and 600 State parks for 300 National parks – and 800 private reserves. Additionally, as development and urbanization define land-use patterns, the likeliness increases that new protected areas and corridors, as well as sustainable land-use mosaics such as biosphere reserves, will come from sub-national and local levels of government. CBD decision VIII/24 on Protected Area, item (f), vi, proposes to increase, where possible, national and local government budgets for protected-area management.

More recently, several references to the contribution of local authorities have come up at SBSTTA-14 and WGRI-3. The draft **CBD Strategic Plan** 2011-2020, as proposed by WGRI-3 under item VI ("Support Mechanisms", paragraph 23 on partnerships and initiatives to enhance cooperation), mentions that initiatives such as promoting engagement of cities and local authorities will contribute to the implementation of the Strategic Plan. Under item V of the draft Strategic Plan (Implementation, Monitoring, Review and Evaluation), WGRI-3 states that it will be implemented primarily through activities at the national and sub-national level, with supporting action at the regional and global levels. One of the targets for the Strategic Plan set by SBSTTA-14 (as strategic goal A, address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society) was that by 2020, the values of biodiversity should be integrated by all countries in their national and local strategies and planning processes, applying the ecosystem approach. SBSTTA-14 also recommended, under the topic of examination of outcome-oriented goals for the Strategic Plan, that the Conference of the Parties recognise the need to contribute to the development and refinement of indicators suitable for monitoring biodiversity at local level.

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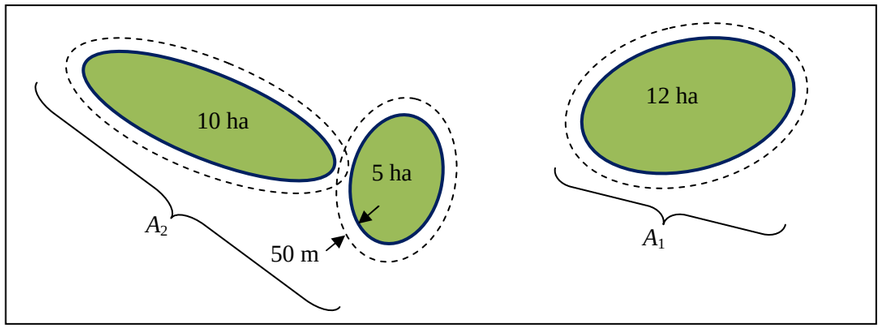
ANNEX B – Illustration of the calculation for Indicator 2

Formula:

$$IND2 = \frac{1}{A_{\text{total}}}\left(A_1^2 + A_2^2 + A_3^2 + ... + A_n^2\right)$$

where *n* is the total number of natural areas (see example below), A_1 to A_n represent the sizes of the natural areas, from natural area 1 to natural area *n*, and A_{total} is the total area of all natural areas together.

Example:



Calculation steps: There are three patches in this landscape. We add a buffer of 50 m around each patch to find out which patches are considered to be connected. When the buffers overlap, the distance of the patches is less than 100 m. We see that the patch on the right (size of 12 ha) is not connected to any other patches. We give it the name A_1 = 12 ha. The two patches on the left are connected. Therefore, their areas have to be added, and we give this group of patches the name A_2 = 10 ha + 5 ha = 15 ha. A_{total} is the sum of A_1 and A_2, i.e., $A_{\text{total}} = 12\text{ ha} + 15\text{ ha} = 27\text{ ha}$. We can now calculate *IND2* as

$$IND2 = \frac{1}{A_{\text{total}}}\left(A_1^2 + A_2^2\right) = \frac{1}{27\text{ ha}}\left(12\times 12\text{ ha}^2 + 15\times 15\text{ ha}^2\right) = \frac{369}{27}\text{ha} = 13.67\text{ ha}.$$

In case that the 5 ha patch and the 10 ha patch were farther apart from each other than 100 m, they would not be considered to be connected, and the value of *IND2* would be much lower, because then all three patches would be considered separately in the formula: $IND2 = \frac{1}{27\text{ ha}}\left(10\times 10\text{ ha}^2 + 5\times 5\text{ ha}^2 + 12\times 12\text{ ha}^2\right) = \frac{269}{27}\text{ha} = 9.96\text{ ha}$.

Cities with difficulties in calculating this indicator may contact Dr. Jochen Jaeger, Email: jjaeger@alcor.concordia.ca; Tel.: (+1) 514 - 848-2424 extension 5481, Fax: (+1) 514 - 848-2032.

For more information, please see the references listed below:

European Environment Agency & Swiss Federal Office for the Environment (2011): *Landscape fragmentation in Europe. Joint EEA-FOEN report*. Authors: J.A.G. Jaeger, T. Soukup, L.F. Madriñán, C. Schwick, F. Kienast. EEA Report No 2/2011, ISSN 1725-9177, ISBN 978-92-9213-215-6, doi:10.2800/78322. Luxembourg, Publications Office of the European Union. 87 pp. Available in printed form and as PDF, online: http://www.eea.europa.eu/publications/landscape-fragmentation-in-europe/

Jaeger, J. A. G. (2000): Landscape division, splitting index, and effective mesh size: new measures of landscape fragmentation. *Landscape Ecology*, vol. 15, issue 2, pp. 115–130.

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Taylor, P.D., Fahrig, L., Henein, K., Merriam, G. (1993): Connectivity is a vital element of landscape structure. *Oikos*, vol. 28, issue 3, pp. 571–573.