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FOR BIODIVERSITY 2011-2020
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**MONITORING BIODIVERSITY CONSERVATION IN CITIES WITH THE SINGAPORE
INDEX ON CITIES' BIODIVERSITY**

Information note by the Executive Secretary

1. The Executive Secretary is pleased to circulate herewith, for the information of participants in the meeting of the Ad Hoc Technical Expert Group on Indicators for the Strategic Plan for Biodiversity 2011-2020, an information document entitled "Monitoring biodiversity conservation in cities with the Singapore Index on Cities' Biodiversity" submitted by the National Parks Board of Singapore.
2. The document is being circulated in the form and language in which it was provided to the Secretariat.

In order to minimize the environmental impacts of the Secretariat's processes, and to contribute to the Secretary-General's initiative for a C-Neutral UN, this document is printed in limited numbers. Delegates are kindly requested to bring their copies to meetings and not to request additional copies.

MONITORING BIODIVERSITY CONSERVATION IN CITIES WITH THE SINGAPORE INDEX ON CITIES' BIODIVERSITY

Introduction

1. In 2008, for the first in humankind's history, more than half of the world's population live in urban areas. It is projected that by 2050, 70% will live in cities. It is not likely that the rate of urbanization will decrease. On the contrary, the effects of urbanization will be further exacerbated by another phenomenon of cities getting larger as indicated by the projection that by 2025 there will be at least 29 megacities. Hence, if biodiversity conservation were to be implemented effectively, urban dwellers will have to play a dominant role.

The need for a city biodiversity index

2. Global Biodiversity Outlook 3 concluded that the 2010 target of significantly reducing the rate of biodiversity loss could not be met. It is generally assumed that cities and biodiversity cannot co-exist. However, interestingly, rich biodiversity has been recorded in cities like Brussels, Curitiba, Edmonton, Montreal, Singapore, etc. We cannot resolve such seemingly contradictory observations if we do not have quantitative data. When a search was carried for biodiversity indices, it was found that there were several environmental indices, e.g., the 2005 Environmental Sustainability Index (Yale Center for Environmental Law and Policy *et al.*, 2005), the 2008 Environmental Performance Index (Yale Center for Environmental Law and Policy *et al.*, 2008), but they ranked countries of a certain size and not cities and they included very few biodiversity indicators. While the Living Planet Report 2008 (WWF International *et al.*, 2008) focussed on some biodiversity indicators, its analyses were based on a larger scale, i.e., at the biogeographical level. A search for indices for cities led to indicators that focussed on economic competitiveness like Cities of Opportunities (PricewaterhouseCoopers LLP & The Partnership for New York City, Inc., 2008). As biodiversity conservation efforts would necessarily need to engage and be implemented at levels like subnational governments, cities and other local authorities as acknowledged at the ninth meeting of the Conference of the Parties to the Convention on Biological Diversity (COP9) in Bonn, Germany, it became apparent that it was necessary to develop an evaluation tool for biodiversity conservation efforts at the city level.

Development of the City Biodiversity Index

3. It was in this light that Mr Mah Bow Tan, Minister for National Development of Singapore, proposed at the high level segment of COP9 on 27 May 2008, the establishment of an index which would be a self-assessment tool to measure biodiversity in cities. Two expert workshops were held in Singapore on the development of the City Biodiversity Index (CBI), the first from 10 to 12 February 2009 and the second from 1 to 3 July 2010.

4. At the first workshop, 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 first workshop. It was agreed that the framework of the index should comprise the following components, that is, (i) Native biodiversity in the city; (ii) ecosystem services provided by biodiversity in the city; and (iii) Good governance and management of native biodiversity in the city. As this Index is developed as a self-assessment tool, it has to be easy, user-friendly, objective, fair, and in particular, scientifically sound. Twenty-five indicators were selected after much deliberation. Each indicator was scored on a 4-point system. 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 (International Union for the Conservation of Nature and Natural Resources), Mr Oliver Hillel (Secretariat of the Convention on Biological Diversity), and Dr Lena Chan (National Parks Board of Singapore), was set up and delegated to prepare the User's Manual for the City Biodiversity

Index. The 21 November 2009 version of the User's Manual for the CBI (Chan *et al.*, 2009) was posted on the CBD website and 15 cities test-bedded the indicators.

5. The Second Expert Workshop on the Development of the CBI was attended by 32 participants, including the SCBD, the Technical Task Force, representatives from ASEAN Working Group on Environmentally Sustainable Cities, Brussels Capital Region, Curitiba, Edmonton, Montpellier (USA), Montreal, Nagoya, Waitakere City, Singapore, resource experts, representatives from Aichi-Nagoya COP10 CBD promotion Committee and international organisations. The 2nd workshop was organised to review comments by cities that have test-bedded the Index, to refine and improve on the indicators based on feedback but retained the essence of the components as agreed at the 1st meeting, and to finalise the User's Manual for the CBI. The deliberations of the workshop discussions were documented in the 27 September 2010 version of the User's Manual (Chan *et al.*, 2010) (Annex 1).

Elements of the CBI

6. The CBI comprises three parts to ensure a comprehensive coverage: a) firstly, the profile of the city like the geographical location, climate, size, population, economic and physical features, biodiversity features, etc., to give a holistic picture of the city; b) secondly, the twenty three indicators evaluated by the city; and c) thirdly, the calculation of the index. The method of scoring is quantitative. Some of the indicators are scored based on statistical normalisation of data provided by at least 20 cities. Since a maximum score of four has been allocated to each indicator, and with the current count of 23 indicators, the maximum score of the CBI is 92 points.

7. The rationale for selecting the indicators, how to calculate the indicators, where to get data for the calculations, and the basis for scoring, are listed in Part II. To facilitate the link between city officials who need the data for the better management of the biodiversity under their jurisdiction and the scientist who collect biodiversity data, an article was published in ***Nature***, to articulate the vision and objectives of the CBI (Chan & Djoghlaif, 2009). Ten indicators selected to measure native biodiversity in the city included the proportion of natural areas in a city, how well connected are the natural ecosystems, are the biodiversity in plant, bird, butterfly and other biodiversity species improving in cities, etc. Attempts to measure ecosystem services in the city were also made for the regulation of quantity of water, carbon storage, cooling effect of vegetation, and recreation and educational services of biodiversity. Nine good governance and management indicators cover a broad spectrum, ranging from budget allocated by cities to biodiversity management, number of biodiversity projects by the city, existence of a local biodiversity strategy and action plan, presence of supporting institutional set-ups like a biodiversity centre, herbarium, zoological museum, etc. The scores of the 23 indicators are totalled to form a single score, i.e., the Index. The Index will be calculated every two years for comparison purposes and for the basis of further rational actions.

Future directions of the CBI

8. The Plan of Action on Subnational Governments, Cities and Other Local Authorities for Biodiversity was endorsed as Decision X/22 at the 10th Meeting of the Conference of the Conference of the Parties to the CBD. In its mission statement, it targets by 2020, as stated in paragraph 3d of the Annex, "..... to set benchmarks for local biodiversity management in line with the 2011-2020 indicator framework using tools such as the Singapore Index on Cities' Biodiversity" (SI). Several of the indicators of the SI mirror the targets of CBD's Strategic Plan for Biodiversity 2011-2020, i.e., the "Aichi Biodiversity Targets" as indicated in Annex 2.

9. Since the release of the SI in public domain, several other potential applications of the SI have been suggested and by cities. Some of the potential applications include a) its use in the master-planning of new towns, b) assisting in the decision-making process on budget allocation,

c) its application as guidelines on how to improve native biodiversity in cities, and d) the biodiversity component of environmental indices.

10. The SI is a dynamic process, which emphasises positive actions that can be taken by cities to improve on its native biodiversity. It has provided a platform for cities to share their success stories. The experience of applying the SI has built capacity, has improved the biodiversity data available for cities, and increased the networking of the government, the non-governmental organisations, the public and the private sector. The indicators in the SI have highlighted mechanisms on how biodiversity can be mainstreamed.

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Prepared by the National Parks Board of Singapore
5 April 2011

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 indicators¹.

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, Montpellier, 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/2/3 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:

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.

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 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 cities 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 address 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 deemed 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.

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

15. 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.
16. 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.
17. 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.
18. 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.

UPDATES ON THE TEST-BEDDING OF THE CBI

19. 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.

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	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)

10. Singapore	6. France: Paris
11. Thailand: Bangkok	7. Indonesia: Padang
12. Thailand: Chiang Mai	8. Indonesia: Pekanbaru
13. Thailand: Krabi	9. Lao PDR: Vientiane
14. Thailand: Phuket	10. Lao PDR: Xayaboury
15. United Kingdom: London	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

* *Some of the cities did not score on all the indicators due to lack of information*

MILESTONES

20. The following highlights the key milestones for the CBI leading up to COP10 in Nagoya, Japan in October 2010.

- 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 organisations and initiatives, engagement of stakeholders, including business and biodiversity, cities and biodiversity, and South/South cooperation".

5. 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 as of 2010 as 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 2010 data 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

PART II: INDICATORS OF THE CITY BIODIVERSITY INDEX

CBI	INDICATORS	VARIABLES	SCORE
Native Biodiversity	INDICATOR 1: PROPORTION OF NATURAL AREAS IN CITY		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u> 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.</p> <p>I.</p> <p>II. 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 Second Expert Workshop on the Development of the City Biodiversity Index that the working definition of “Natural Areas” is as follows:</p> <p>III.</p> <p>IV. 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 or enhance native biodiversity.</p> <p>V.</p> <p>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.</p>	<p><u>HOW TO CALCULATE INDICATOR</u> (Total area of natural areas) ÷ (Total area of city)</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u> 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.</p>	<p><u>BASIS OF SCORING</u> Based on the assumption that, by definition, a city comprises mainly man-made landscapes, the maximum score will be set at more than 0.20 of the total city area would be covered by natural areas</p> <p>0 point : < 0.01 1 point: 0.01 – 0.06 2 points: 0.07 – 0.13 3 points : 0.14 – 0.20 4 points : > 0.20</p>

CBI	INDICATORS	VARIABLES	SCORE
Native Biodiversity	INDICATOR 2: CONNECTIVITY MEASURES OR ECOLOGICAL NETWORKS TO COUNTER FRAGMENTATION		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u></p> <p>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.</p> <p>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.</p> <p>This indicator score can be improved when more of the fragments are connected.</p> <p style="text-align: right;">VI.</p> <p>VII.</p> <p style="text-align: right;">VIII.</p>	<p><u>HOW TO CALCULATE INDICATOR</u></p> <p>IX. (Total area of natural areas that are linked) ÷ (Total area of natural areas)</p> <ul style="list-style-type: none"> • Patches that are <100m apart should be considered as linked. • Individual cities can decide on the width and composition of a link as applicable in their context. Examples of links include green corridors, underground faunal crossings, overarching canopies that function as links for small animals, etc. <p>X.</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u></p> <p>Satellite images can be used in the computation of this indicator.</p>	<p><u>BASIS OF SCORING</u></p> <p>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.</p> <p><i>[scoring range to be determined]</i></p>

CBI	INDICATORS	VARIABLES	SCORE
Native Biodiversity	INDICATOR 3: NATIVE BIODIVERSITY IN BUILT-UP AREAS (BIRD SPECIES)		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u></p> <p>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 have 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.</p> <p>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.</p>	<p><u>HOW TO CALCULATE INDICATOR</u></p> <p>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.</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u></p> <p>City councils, universities, NGOs, etc.</p>	<p><u>BASIS OF SCORING</u></p> <p>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.</p> <p><i>[scoring range to be determined]</i></p>

CBI	INDICATORS	VARIABLES	SCORE
Native Biodiversity	INDICATORS 4 - 8: CHANGE IN NUMBER OF NATIVE SPECIES		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u></p> <p>As this is an index focussing on biodiversity in cities, it is essential that the native flora and fauna diversity be incorporated as indicators.</p> <p>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.</p> <p>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</p> <ul style="list-style-type: none"> • 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. 	<p><u>HOW TO CALCULATE INDICATORS</u></p> <p>The total number of native species is used for Indicators 4 to 8. The 3 core groups are:</p> <ul style="list-style-type: none"> - Indicator 4 : vascular plants - Indicator 5 : birds - Indicator 6 : butterflies <p>These groups have been selected as data are most easily available and to enable some common comparison.</p> <p>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.)</p> <p>The above data for 2010 would be recorded in Part I: Profile of the City as the baseline.</p> <p>Net change in species from the previous survey to the most recent survey is calculated as:</p> <p>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</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u></p> <p>Possible sources of data include government agencies in charge of biodiversity, city municipalities, urban planning agencies, biodiversity centres, nature groups, universities, publications, etc.</p>	<p><u>BASIS OF SCORING</u></p> <p>Data listed in Part I: Profile of the City will be used to measure change in species diversity every 2 years. The 2010 data will be the baseline for monitoring in 2012.</p> <p>In 2012, 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.</p> <p>0 point: 0 species or less 1 point: 1 species 2 points: 2 species 3 points: 3 species 4 points: 4 species or more</p>

	<p>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.</p>		
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CBI	INDICATORS	VARIABLES	SCORE
Native Biodiversity	INDICATOR 9: PROPORTION OF PROTECTED NATURAL AREAS		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u></p> <p>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.</p>	<p><u>HOW TO CALCULATE INDICATOR</u></p> <p>(Area of protected or secured natural areas) ÷ (Total area of the city)</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u></p> <p>Possible sources of data include government agencies in charge of biodiversity, city municipalities, urban planning agencies, biodiversity centres, nature groups, universities, publications, etc.</p>	<p><u>BASIS OF SCORING</u></p> <p>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.</p> <p><i>[scoring range to be determined]</i></p>

CBI	INDICATORS	VARIABLES	SCORE
Native Biodiversity	INDICATOR 10: PROPORTION OF INVASIVE ALIEN SPECIES (AS OPPOSED TO NATIVE SPECIES)		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u></p> <p>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.</p> <p>The definition of alien invasive species adopted follows that accepted by the SCBD, i.e.:</p> <p style="padding-left: 20px;">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).</p> <p>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.</p> <p>Cities can decide on the taxonomic groups which are most problematic for their city or where most data are available.</p>	<p><u>HOW TO CALCULATE INDICATOR</u></p> <p>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.</p> <p>(Number of invasive alien species) ÷ (Number of native species)</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u></p> <p>Possible sources of data include government agencies in charge of biodiversity, city municipalities, urban planning agencies, biodiversity centres, nature groups, universities, publications, etc.</p>	<p><u>BASIS OF SCORING</u></p> <p>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.</p> <p>0 point : > 0.30 1 point : 0.21-0.30 2 points : 0.11-0.20 3 points : 0.01-0.10 4 points : < 0.01</p>

CBI	INDICATORS	VARIABLES	SCORE
	INDICATOR 11: REGULATION OF QUANTITY OF WATER		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u></p> <p>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.</p>	<p><u>HOW TO CALCULATE INDICATOR</u></p> <p>Proportion of all permeable areas (including areas identified in Indicator 1 plus other parks, roadside greenery, private gardens, streams, rivers, etc.) to total terrestrial area of city (excluding marine areas, if applicable)</p> <p>(Total permeable area) ÷ (Total terrestrial area of the city)</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u></p> <p>Possible sources of data include government environmental agencies, city municipalities, urban planning, water and land agencies, satellite images, etc.</p>	<p><u>BASIS OF SCORING</u></p> <p>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.</p> <p><i>[scoring range to be determined]</i></p>

CBI	INDICATORS	VARIABLES	SCORE
	INDICATOR 12: CLIMATE REGULATION: CARBON STORAGE AND COOLING EFFECT OF VEGETATION		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u></p> <p>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.</p> <p>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.</p> <p>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.</p> <p>Planting of native trees to increase the canopy cover is encouraged.</p> <p>This is an indicator that is optional for cities in the desert or arid zones or other ecological zones where this might not be applicable.</p>	<p><u>HOW TO CALCULATE INDICATOR</u></p> <p>Carbon storage and cooling effect of vegetation</p> <p>$(\text{Tree canopy cover}) \div (\text{Total terrestrial area of the city})$</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u></p> <p>City councils and satellite images</p>	<p><u>BASIS OF SCORING</u></p> <p>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.</p> <p><i>[scoring range to be determined]</i></p>

CBI	INDICATORS	VARIABLES	SCORE
	INDICATORS 13 –14: RECREATIONAL AND EDUCATIONAL SERVICES		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u></p> <p>Biodiversity provides invaluable recreational, spiritual, cultural and educational services. It is essential for physical and psychological health.</p>	<p><u>HOW TO CALCULATE INDICATOR</u></p> <p><u>Indicator 13:</u> (Area of parks with natural areas and protected or secured natural areas)* / 1000 persons</p> <p>*Some cities refer to this as accessible green spaces</p> <p><u>Indicator 14:</u> Number of formal educational visits per child below 16 years to parks with natural areas or protected or secured natural areas per year</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u></p> <p>Indicator 13: City councils</p> <p>Indicator 14: School records</p>	<p><u>BASIS OF SCORING</u></p> <p><u>Indicator 13:</u> 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</p> <p><u>Indicator 14:</u> 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</p>

CBI	INDICATORS	VARIABLES	SCORE
	INDICATOR 15: BUDGET ALLOCATED TO BIODIVERSITY		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u></p> <p>The first two components measured the biodiversity in the city and the ecosystem services provided by the city. This indicator evaluates what programmes and projects are put in place to ensure the maintenance and enhancement of biodiversity in cities.</p>	<p><u>HOW TO CALCULATE INDICATOR</u></p> <p>(Amount spent on biodiversity related administration) ÷ (Total budget of city)</p> <p>Computation should include the city's or municipality's manpower budget as well as its operational and biodiversity related project expenditure.</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u></p> <p>Possible sources of data include government agencies responsible for biodiversity conservation and finance departments.</p>	<p><u>BASIS OF SCORING</u></p> <p>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.</p> <p><i>[scoring range to be determined]</i></p>

CBI	INDICATORS	VARIABLES	SCORE
Governance and Management	INDICATOR 16: NUMBER OF BIODIVERSITY PROJECTS IMPLEMENTED BY THE CITY ANNUALLY		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u></p> <p>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.</p>	<p><u>HOW TO CALCULATE INDICATOR</u></p> <p>Number of projects that are being implemented by the city authorities, private sector, NGOs, etc. per year</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u></p> <p>Possible sources of data include city authorities, private sector, NGOs, etc.</p>	<p><u>BASIS OF SCORING</u></p> <p>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.</p> <p><i>[scoring range to be determined]</i></p>

CBI	INDICATORS	VARIABLES	SCORE
Governance and Management	INDICATOR 17: RULES, REGULATIONS AND POLICY – EXISTENCE OF LOCAL BIODIVERSITY STRATEGY AND ACTION PLAN		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u></p> <p>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).</p> <p>Some of the CBD initiatives include plant conservation, forest biodiversity, global taxonomy initiative, invasive species programme, marine biodiversity conservation, protected areas, etc.</p>	<p><u>HOW TO CALCULATE INDICATOR</u></p> <p>Status of Local Biodiversity Strategy and Action Plan (LBSAP); number of associated CBD initiatives</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u></p> <p>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</p>	<p><u>BASIS OF SCORING</u></p> <p>To ensure that biodiversity is conserved in a city, it is advisable to draw up a LBSAP. This needs to be aligned with the NBSAP so that biodiversity conservation efforts are synchronised and synergised.</p> <p>0 point : No LBSAP*</p> <p>1 point : LBSAP not aligned with NBSAP</p> <p>2 points : LBSAP incorporates elements of NBSAP, but does not include any CBD initiatives**</p> <p>3 points : LBSAP incorporates elements of NBSAP, and includes 1 to 3 CBD initiatives</p> <p>4 points : LBSAP incorporates elements of NBSAP, and includes more than 4 CBD initiatives</p> <p>* LBSAP or equivalent</p> <p>** 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</p>

CBI	INDICATORS	VARIABLES	SCORE
Governance and Management	INDICATORS 18 – 19: INSTITUTIONAL CAPACITY		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u></p> <p>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.</p> <p>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.</p> <p>Many biodiversity issues are cross-sectoral and, hence, involve inter-agencies. 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.</p>	<p><u>HOW TO CALCULATE INDICATOR</u></p> <p>Indicator 18: Number of essential biodiversity-related functions*</p> <p><i>* The functions could include the following: biodiversity centre, botanical garden, herbarium, zoological garden or museum, insectarium, etc.</i></p> <p>Indicator 19: Number of city or local government agencies involved in inter-agency cooperation pertaining to biodiversity matters</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u></p> <p>City councils</p>	<p><u>BASIS OF SCORING</u></p> <p>Indicator 18: 1 point : 1 function 2 points : 2 functions 3 points : 3 functions 4 points : > 3 functions</p> <p>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</p> <p><i>* Agencies could include department or authorities responsible for biodiversity, planning, water, transport, development, etc.</i></p>

CBI	INDICATORS	VARIABLES	SCORE
	INDICATORS 20 – 21: PARTICIPATION AND PARTNERSHIP		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u></p> <p>Indicator 20 evaluates the existence and the state of formal or informal public consultation process pertaining to biodiversity-related matters.</p> <p>Indicator 21 measures the extent of informal and/or formal partnerships. 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.</p>	<p><u>HOW TO CALCULATE INDICATOR</u></p> <p>Indicator 20: Existence and state of formal or informal public consultation process pertaining to biodiversity-related matters</p> <p>Indicator 21: Number of agencies/ private companies/ NGOs/ academic institutions/ international organisations with which the city is partnering in biodiversity activities, projects and programmes</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u></p> <p>City councils</p>	<p><u>BASIS OF SCORING</u></p> <p>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</p> <p>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</p>

CBI	INDICATORS	VARIABLES	SCORE
	INDICATORS 22 - 23: EDUCATION AND AWARENESS		
	<p><u>RATIONALE FOR SELECTION OF INDICATOR</u></p> <p>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. Whereas, Indicator 14 gives an indication of school children's use of recreational services provided by ecosystems, Indicators 22 and 23 highlight:</p> <p>(i) whether biodiversity is included in the school curriculum; and</p> <p>(ii) the number of outreach or public awareness events are held per year?</p> <p>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.</p>	<p><u>HOW TO CALCULATE INDICATOR</u></p> <p><u>Indicator 22:</u> Is biodiversity or nature awareness included in the school curriculum (e.g. biology, geography, etc.)</p> <p><u>Indicator 23:</u> Number of outreach or public awareness events held in the city per year</p> <p><u>WHERE TO GET DATA FOR CALCULATIONS</u></p> <p>Education department, city councils, NGOs</p>	<p><u>BASIS OF SCORING</u></p> <p><u>Indicator 22:</u></p> <p>0 point : Biodiversity or elements of it are not covered in the school curriculum</p> <p>1 point : Biodiversity or elements of it are being considered for inclusion in the school curriculum</p> <p>2 points : Biodiversity or elements of it are being planned for inclusion in the school curriculum</p> <p>3 points : Biodiversity or elements of it are in the process of being implemented in the school curriculum</p> <p>4 points : Biodiversity or elements of it are included in the school curriculum</p> <p><u>Indicator 23:</u></p> <p>0 point : 0 outreach events/ year</p> <p>1 point : 1 - 59 outreach events / year</p> <p>2 points : 60 -149 outreach events / year</p> <p>3 points : 150-300 outreach events / year</p> <p>4 points : > 300 outreach events / year</p>

PART III: CALCULATION OF THE INDEX

INDICATOR	CALCULATION	SOURCE	SCORE
Native Biodiversity in the City			
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Ecosystem Services Provided by Biodiversity in the City			
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Governance and Management of Biodiversity in the City			
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ANNEX

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.

CBD Strategic Plan 2011 – 2020 Targets	Singapore Index on Cities' Biodiversity Indicators Relevant to the Strategic Plan Targets
<u>Target 1:</u> by 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably	Indicators 22 & 23
<u>Target 2:</u> By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems	Indicators 17, 18, 19 & 20
<u>Target 3:</u> By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio-economic conditions.	Indicator 15
<u>Target 4:</u> By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	Indicator 21
<u>Target 5:</u> By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	Indicators 1 & 2
<u>Target 6:</u> By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.	Indicators 17, 19, 20 & 21
<u>Target 7:</u> By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	Indicators 19, 20, 21
<u>Target 8:</u> By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity	Indicators 19, 20, 21
<u>Target 9:</u> By 2020, invasive species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and	Indicator 10

CBD Strategic Plan 2011 – 2020 Targets	Singapore Index on Cities' Biodiversity Indicators Relevant to the Strategic Plan Targets
establishment	
<u>Target 10:</u> By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning	Indicators 17, 21
<u>Target 11:</u> By 2020, at least 17 percent of terrestrial and inland water, and 10 percent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascapes	Indicators 1, 2, 9 & 21
<u>Target 12:</u> By 2020, the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	Indicators 1 - 8
<u>Target 13:</u> By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity	Indicators 1 - 9
<u>Target 14:</u> By 2020, ecosystems that provide essential services, including Services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable	Indicators 11, 12, 13, 14
<u>Target 15:</u> By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 percent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification	Indicators 1, 2, 4, 5, 6, 7, 8 & 9
<u>Target 16:</u> By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation	Indicator 17
<u>Target 17:</u> By 2015, each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan	Indicator 17
<u>Target 18:</u> By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary	Indicator 17

use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities at all relevant levels	
<u>Target 19</u> : By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied	Indicators 18, 19, 20, 21 & 22
<u>Target 20</u> : By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan 2011 – 2020 from all sources and in accordance with the consolidated and agreed process in the Strategy of Resource Mobilization should increase substantially from the current levels. This target will be subject to changes contingent to resources needs assessments to be developed and reported by Parties.	Indicator 15

Indicators of the Singapore Index on Cities' Biodiversity:

- Indicator 1: Proportion of Nature Areas in City
- Indicator 2: Connectivity Measures or Ecological Networks to Counter Fragmentation
- Indicator 3: Native Biodiversity in Built-Up Areas (Bird species)
- Indicator 4: Change in Number of Vascular Plant Species
- Indicator 5: Change in Number of Bird Species
- Indicator 6: Change in Number of Butterfly Species
- Indicator 7: Change in Number of First Species Selected by City
- Indicator 8: Change in Number of Second Species Selected by City
- Indicator 9: Proportion of Protected Natural Areas
- Indicator 10: Proportion of Invasive Alien Species
- Indicator 11: Regulation of Quantity of Water – Proportion of Permeable Area in City
- Indicator 12: Carbon Storage and Cooling Effect of Vegetation – Proportion of Tree Cover in City
- Indicator 13: Recreational Services – Park ratio
- Indicator 14: Educational Services – Number of formal educational visits per child below 16 to parks with natural areas or protected or secured natural areas per year
- Indicator 15: Budget Allocated to Biodiversity
- Indicator 16: Number of Biodiversity Projects Implemented by the City Annually
- Indicator 17: Existence of Local Biodiversity Strategy and Action Plan
- Indicator 18: Biodiversity-related Institutional Capacity
- Indicator 19: Mainstreaming of Biodiversity
- Indicator 20: Existence of Formal or Informal Public Consultation Processes Pertaining to Biodiversity-related matters
- Indicator 21: Participation and Partnership in Biodiversity Activities, Projects and Implementation
- Indicator 22: Incorporation of Biodiversity into the School Curriculum
- Indicator 23: Number of Outreach or Public Awareness Events Held in the City Annually
