सूचना का अधिकार
RIGHT TO INFORMATION

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

No. WII/RTI/CPIO/2023-24/QTR-2/62 **Date: 09.01.2024**

सेवा में

डॉ.सुभाष सी पाण्डेय
HIG 1/8, शिवानी काम्प्लेक्स
6 नो. बस स्टॉप
भोपाल-४६२०१३

विषय: सूचना का अधिकार अधिनियम, 2005 के अंतर्गत सूचना के संबंध में
संदर्भ : १- आपका आर टी आई नंबर NIL दिनांक ४.९.२०२३

२- पत्र संख्या- ३४३२ –A L / आर टी आई /२३ दिनांक २०.१२.२०२३

श्रीमान,

कृपया आरटीआई अधिनियम, 2005 के तहत ऊपर दिए गए अपने आवेदन को देखें। आपके द्वारा मांगी गई जानकारी संस्थान के संबंधित प्राधिकरण से एकत्र की गई है और इसके साथ **परिशिष्ट-I** (96 pages)के रूप में संलग्न है। आपके प्रश्नों का विंदुवार उत्तर नीचे दिया गया है:

S.No.	Information Sought	Reply of WII
1.	दैनिक भास्कर की एस पी ए भोपाल एवं वाइल्डलाइफ इंस्टिट्यूट ऑफ़ इंडिया देहरादून के साथ मिलकर उक्त महत्त्वपूर्ण एवं संवेदनशील शोध कार्य करने सम्बन्धी अनुबंध / सहमती पत्र की प्रमाणित प्रतिया प्रदान करे	भारतीय वन्यजीव संस्थान (डब्ल्यू आई आई) देहरादून का दैनिक भास्कर और स्कूल ऑफ प्लानिंग एंड आर्किटेक्चर (एसपीए) भोपाल के साथ कोई आधिकारिक सहयोग नहीं है।
2.	उक्त शोध कार्य हेतु वाइल्डलाइफ इंस्टिट्यूट ऑफ़ इंडिया देहरादून की ओरसे एक एक्सपर्ट (डॉ. गौतम तालुकदार) को मीडिया के साथ भोपाल की आबोहवा, स्थानीय हवा, ग्रीनरी, बायोडायवर्सिटी, जल, जंगल और इकॉनामी पर मिलकर काम करने की अनुमति प्रदान करने विषयक सस्थान द्वारा जरी किये गए दस्तावेजो की प्रमाणित प्रतिया प्रदान करे	विंदु 1 के समान
3.	उक्त कार्य हेतु वाइल्डलाइफ इंस्टिट्यूट ऑफ़ इंडिया देहरादून के एक्सपर्ट (डॉ. गौतम तालुकदार) को संसथान एवं मीडिया द्वारा प्रदान की गई समस्त सुविधाओ अवकाश, पारिश्रमिक एव मानदेय बावत जारी दस्तावेजो की प्रमाणित प्रतिया प्रदान करे	डब्ल्यू आई आई या किसी मीडिया हाउस से कोई सुविधा/छुट्टियां/मानदेय नहीं लिया गया है।
4.	उक्त विश्यान्तार्गत एस पी ए भोपाल एवं वाइल्डलाइफ इंस्टिट्यूट ऑफ़ इंडिया,देहरादून के द्वारा दैनिक भास्कर के साथ सामूहिक रूप से शोध कार्य करने की विश्तृत रूप से प्रकाशित रिपोर्ट में ही दैनिक भास्कर द्वारा, दोनों केंद्रीय संस्थानों के "लोगो" का भी इस्तेमाल किया गया है/ अतः वाइल्डलाइफ इंस्टिट्यूट ऑफ़ इंडिया,देहरादून द्वारा शोध पत्र/ शोध कार्य करने के अतिरिक्त इसके प्रकाशन एवं मीडिया रिपोर्ट में वाइल्डलाइफ इंस्टिट्यूट ऑफ़ इंडिया,देहरादून का "लोगो" इस्तेमाल करने अनुमति प्रदान करने सम्बन्धी स्वीकृति/ आदेश पत्र की प्रमाणित प्रतिया प्रदान करे	विंदु 1 के समान

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5.	किसी निजी संस्थान/ व्यक्ति द्वारा वाइल्डलाइफ इंस्टिट्यूट ऑफ़ इंडिया का "लोगो" इस्तेमाल अथवा दुरूपयोग करने सम्बन्धी निर्धारित नियम, निर्देश एवं दिशा निर्देश बताने वाले भारत शासन, मंत्रालय अथवा वाइल्डलाइफ इंस्टिट्यूट ऑफ़ इंडिया मुख्यालय द्वारा जारी अभिलेखों की प्रमाणित प्रतिया प्रदान करे	WII सरकार द्वारा 'लोगो' के उपयोग के लिए standard कॉपी राइट दिशा निर्देशों का पालन करता है। इस संबंध मे अलग से दिशा निर्देश जारी नहीं किये गये हैं.
6.	विष्यान्तार्गत वाइल्डलाइफ इंस्टिट्यूट ऑफ़ इंडिया,देहरादून द्वारा अथवा समस्त अनुबंधकर्ताओ द्वारा सामूहिक रूप से इस बावत किये गए शोध कार्यो/ शोध निष्कर्षो/ शोध प्रविधियों/ प्रपत्रों की प्रमाणित प्रतिया प्रदान करे	भोपाल शहर जैव विविधता सूचकांक रिपोर्ट मध्य प्रदेश राज्य जैव विविधता बोर्ड (एमपीएसबीबी) को प्रस्तुत की गई है और इसे पृष्ठ 4-99 में रखा गया है।
7.	दैनिक भास्कर, भोपाल के मुख्य पृष्ठ पर वाइल्डलाइफ इंस्टिट्यूट ऑफ़ इंडिया,देहरादून के वरीष्ठ डॉ. गौतम तालुकदार के (मय प्रकाशित फोटो) द्वारा उपरोक्त विश्यान्तार्गत समुहिक रुप से अथवा अलग-अलग प्रस्तुत शोध कार्यो/ तथ्यों की प्रमाणित प्रतिया प्रदान करे	बिंदु 6 के समान
8.	उक्त विश्यान्तार्गत दैनिक भास्कर के मुख्य पृष्ठ पर प्रकाशित विषयों/ तथ्यों को प्रस्तुत करने वाले कार्यो/ निष्कर्ष/ तथ्यों की वैज्ञानिकता को प्रमाणित करने वाले संदर्भ ग्रंथो, शोधग्रंथो, सहायक शोधग्रंथो, डाक्यूमेंट्स (रिफरेन्स बुक / articals) की प्रमाणित प्रतिया प्रदान करे	बिंदु 6 के समान

यदि आप उपरोक्त उत्तर से संतुष्ट नहीं हैं, तो आप इस पत्र की प्राप्ति की तारीख से 30 दिनों के भीतर नीचे दिए गए विवरण के अनुसार अपीलीय प्राधिकारी को अपील कर सकते हैं।

रजिस्ट्रार,
एफएए और रजिस्ट्रार
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आपकी विश्वासी

बलजीत कौर

[बलजीत कौर]
केन्द्रीय लोक सूचना अधिकारी

CITY BIODIVERSITY INDEX

BHOPAL

2023

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Implementing agency

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

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D.O.No. 355

Bhopal, Date 06/02/2023

MESSAGE

Bhopal is one of several boom cities in India that are emerging as large markets due to a rapid growth in population, urbanisation and disposable incomes. While these are welcome trends for an aspirational population, they can also have grave impacts such as significant landscape changes that lead to loss of biodiversity.

Once placed among the greenest cities in India, Bhopal has its share of environmental issues today, such as loss of green cover, encroachment of lakes and water pollution. It is to help address these issues that the Madhya Pradesh State Biodiversity Board (MPSBB) initiated a project in 2021 to prepare the City Biodiversity Index for Bhopal. The City Biodiversity Index is a tool that helps cities to measure and better manage their biodiversity. Conservation and enhancement of biodiversity and ecosystems in cities is very important as they provide environmental as well as socio economic benefits, and can contribute to better climate and disaster resilience.

A lot of effort has been taken to prepare Bhopal's City Biodiversity Index and I am sure that it will play a key role in helping the city conserve and enhance its green and blue assets, and reinforce its vision to become a liveable and sustainable space. We are grateful to Madhya Pradesh State Biodiversity Board (MPSBB), Wildlife Institute of India (WII) and ICLEI- Local Goverments for Sustainability, South Asia for the invaluable support they provided in making this initiative a success. I hope this report motivates other urban centres in Madhya Pradesh to adopt similar measures to conserve their natural ecosystems.

(J. N. Kansotiya)

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भा.व.से.
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वन बल प्रमुख, मध्यप्रदेश
Ramesh Kumar Gupta
IFS
Principle Chief Conservator of Forests &
Head of Forest Force, Madhya Pradesh

मध्यप्रदेश वन विभाग
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अ.शा.प.क्र./Do.No. 43

दिनांक/Date 02-01-2023

MESSAGE

Biological diversity represents the natural wealth of our planet, and provides the basis for life and prosperity of mankind. However, biodiversity is currently vanishing at an alarming rate due to a variety of human activities.

We need to respond to these challenges by rethinking our plans and policies. And we can no longer see biodiversity as being restricted to forests and rural areas; cities, too, play a critical role in biodiversity conservation.

In recognition of this key fact, Bhopal has taken a step in the right direction by developing its City Biodiversity Index, which will help it to evaluate and monitor biodiversity conservation efforts against its own individual baselines. The Madhya Pradesh Forest Department is committed to conservation of biodiversity in Bhopal city, and the development of the City Biodiversity Index is a key achievement of our efforts in this direction.

I would like to take this opportunity to thank Wildlife Institute of India and ICLEI- Local Governments for Sustainability, South Asia for their assistance and expertise in developing the City Biodiversity Index, which will help Bhopal to take proactive steps towards biodiversity conservation and contribute to the attainment of the National Biodiversity Targets and the Post 2020 Global Biodiversity Framework, thus supporting the implementation of the Convention on Biological Diversity.

R.gupta

(Ramesh Kumar Gupta)

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D.O. No. 371 /2023
Bhopal, Dated 7.2.2023

MESSAGE

Urban areas must put nature at the heart of urban development to build resilience to environmental and climate risks. While the city of Bhopal is naturally endowed with beautiful lakes and green areas, they are at great risk due to human activities driven by urbanisation and development. Here, we have a responsibility to protect these areas for the benefit of future generations.

I am happy to say that Bhopal's City Biodiversity Index will help us to improve our understanding of the biodiversity wealth in the city and develop effective governance mechanisms and conservation strategies. The City Biodiversity Index comprises background information on the city and 23 indicators that make up the index. The overall exercise in developing the City Biodiversity Index documented valuable information on 488 species of plants, 274 species of birds, 85 species of butterflies, 36 species of herpetofauna, and 44 species of fish from various studies conducted within the city limits, apart from understanding the ecosystem services that are being provided by the green and blue ecosystems in the city.

I thank Wildlife Institute of India and ICLEI- Local Goverments for Sustainability, South Asia for developing the City Biodiversity Index of Bhopal.

(Dr. Atul Kumar Srivastava)

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

MESSAGE

Convention on Biological Diversity (CBD) in its ninth meeting of the Conference of Parties enacted a concept of City Biodiversity Index (CBI), which is a self-assessment tool for cities to evaluate their biodiversity conservation efforts.

Madhya Pradesh State Biodiversity Board in collaboration with Wildlife Institute of India and ICLEI South Asia computed the CBI of Bhopal. CBI comprises 23 indicators under three core components- native biodiversity, ecosystem services, and governance and management of biodiversity in the city. The exercise collated and documented information on 488 species of plants, 274 species of birds, 85 species of butterflies, 36 species of herpetofauna, 44 species of fish from various studies conducted within the city. These results are encouraging. Van Vihar National Park, 14 City Forests, Bhoj Wetland, Barkatullah University Campus and IIFM Campus are important biodiversity rich areas of Bhopal.

City Biodiversity Index is meant to be used as a tool for a city to measure their own progress towards improving biodiversity conservation efforts and therefore serves as a benchmark for the existing efforts. It is unwise to compare City Biodiversity Index of two cities, as each city has its own local context, demographics, strengths, weaknesses, resources and capacity.

Bhopal, the capital city of Madhya Pradesh is growing at a rapid pace; Urban Local Bodies have an important role to develop the city sustainably and make it livable for its citizens. City Biodiversity Index of Bhopal therefore should be repeated after every four years preferably by Urban Local Bodies to evaluate the progress of conservation efforts over time. Results in trend are more important than the absolute score for a city.

I strongly revere the government of Madhya Pradesh for taking this significant step of launching CBI for Bhopal and look forward for this exercise to be taken up on the other cities, in the face of biodiversity conservation.

[V.R. Tiwari] 7/3/23
Director

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Acknowledgements

Preparation of City Biodiversity Index (CBI) of Bhopal involved collection of large number secondary data. These data sets received from various stakeholders, Line Departments, Institutions, City Authorities and Universities. We are thankful to all these organisations in providing their support in computing the CBI of Bhopal.

We would like to thank the Madhya Pradesh State Biodiversity Board (MPSBB) for providing funding and all necessary support in developing CBI of Bhopal. Special thanks to the current Member Secretary- Dr. Atul Kumar Srivastava and Assistant Member Secretatry- Dr. Bakul Lad; Former Member Secretaries- Dr. Dharmendra Verma and Shri Jasbir Singh Chauhan.

We would like to acknowledge the in-house support rendered during the study by the Director of WII- Shri V.R. Tiwari, Former Directors of WII-Dr. S.P. Yadav and Dr. Dhananjai Mohan; Dean-FWS- Dr. Ruchi Badola; Registrar- Dr. S. Sathyakumar and other Faculty Colleagues of WII.

We extend our thankfulness to Dr. Vivek Sarkar and Mr. Debanjan Sarkar, researchers, Wildlife Institute of India for their support in preparation of species list.

We would like to express our gratitude to the Officials of Forest Department for rendering all support in providing data, coordination with stakeholders, and technical support during the study.

We are greatful to the officials and staff of the Municipal Corporation and Smart City for assisting in collection of data. Also thanks to NGOs and Universities such as WWF Bhopal, Tinsa Ecological Group, The Nature Volunteers, Barkatullah University, Sarojini Naidu PG College etc. for giving their inputs.

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Abbreviations

ABS	Access and Benfit Sharing
AIIMS	All India Institute of Medical Sciences
BHEL	Bharat Heavy Electricals Limited
BMC	Biodiversity Management Committee
BSCDCL	Bhopal Smart City Development Corporation Limited
CBD	Convention of Biological Diversity
CBI	City Biodiversity Index
CPA	Capital Project Authority
CSIR-AMPR	Council of Scientific And Industrial Research–Advanced Materials And Process Research
CSO	Civil Society Organisations
CYOB	Carry Your Own Bag
EPCO	Environmental Planning & Coordination Organisation
GDP	Gross domestic product
ha	Hectare
IIFM	Indian Institute of Forest Management
IISER	Indian Institute of Science, Education and Research
LBSAP	Local Biodiversity Strategy and Action Plan
LULC	Land Use Land Cover
MANIT	Maulana Azad National Institute of Technology Bhopal
MP	Madhya Pradesh
MPEDB	Madhya Pradesh Ecotourism Development Board
MPSBB	Madhya Pradesh State Biodiversity Board
NA Map	Natural Asset Map
NBSAP	National Biodiversity Strategy and Action Plan
NGO	Non-Governmental Organization
NIFT	National Institute of Fashion Technology
NID	National Institute of Design
NSS	National Service Scheme
Nparks	National Parks Board
PCCF	Principal Chief Conservator of Forests
PPP	Purchasing Power Parities
SCBD	Secretariat of the Convention on Biological Diversity
sq km	Square Kilometer
RF	Revenue Forest
TNV	The Nature Volunteers
ULBs	Urban Local Bodies
USGS	United States Geological Survey
VVNP	Van Vihar National Park
WII	Wildlife Institute of India
WWF	World Wildlife Fund

SUMMARY

Hosting more than half of the world's population, the inclusion of cities in the global conversation around biodiversity conservation becomes all the more relevant whether because of their location at important ecosystem junctions, or in areas of high biodiversity and or because of the impacts they have on an area's natural resources. Recognising this, Convention on Biological Diversity (CBD) in 2008 conceptualised the first global biodiversity index for urban areas, 'City Biodiversity Index (CBI)' or the 'Singapore Index on Cities Biodiversity'. The index is a self-assessment tool for cities to evaluate and monitor the progress of their biodiversity conservation efforts across subsequent applications of the tool.

Considering the importance of the CBI, Madhya Pradesh State Biodiversity Board (MPSBB) initiated a project in 2021 to prepare the City Biodiversity Index for the cities of Bhopal and Indore, Madhya Pradesh with technical support from Wildlife Institute of India (WII), Dehradun and ICLEI South Asia, New Delhi.

The CBI of Bhopal has been prepared as per the guidelines and methodology provided in the User's Manual on the Singapore Index on Cities' Biodiversity, endorsed by the CBD in 2014. It comprises the following sections, a 'Profile of the City', which provides background information on the city; and the 23 indicators that make up the index. The 23 indicators are grouped across three main components viz. Native Biodiversity, Ecosystem Services provided by biodiversity and Governance and Management of biodiversity.

The overall exercise collated and documented information on 488 species of plants, 274 species of birds, 85 species of butterflies, 36 species of herpetofauna, 44 species of fishes from various studies conducted within the city limits. A Natural Asset Map was also prepared which highlighted 12 land classes. Van Vihar National Park, 14 City Forests, Bhoj Wetland, Barkatullah University Campus and IIFM Campus are important biodiversity repositories in Bhopal.

The city scored a total of 44 out of 72 for 18 indicators **(Table 1, Figure 1**). Since this is the baseline year, indicators 4-8 were not considered for the analysis. The first section on "Native Biodiversity in the City", contributed to a score of 16 out of 20 as only 5 indicators were taken into consideration. The city scores well in this section, indicating that its wetland and forest habitats support significant biodiversity. A large proportion of this score is due to the wetland ecosystems.

Indicators 11-14, which relate to "Ecosystem Services Provided by Biodiversity in the City" contributed 9 out of 16 points. This is a fair score but can be improved by focussing on interventions that address the health of its natural ecosystems.

Indicators 15-23, which correspond to "Governance and Management of Biodiversity in the City" contributed to a score of 19 out of 36 points. This is an average score, indicating that there are some governance mechanisms already in place that may benefit biodiversity and local ecosystems however these need to be strengthened.

This report will act as a baseline for future monitoring and assessment of biodiversity within the city of Bhopal. The recommendations set out under each indicator are aimed at guiding the city administration in taking actions towards improving their future score.

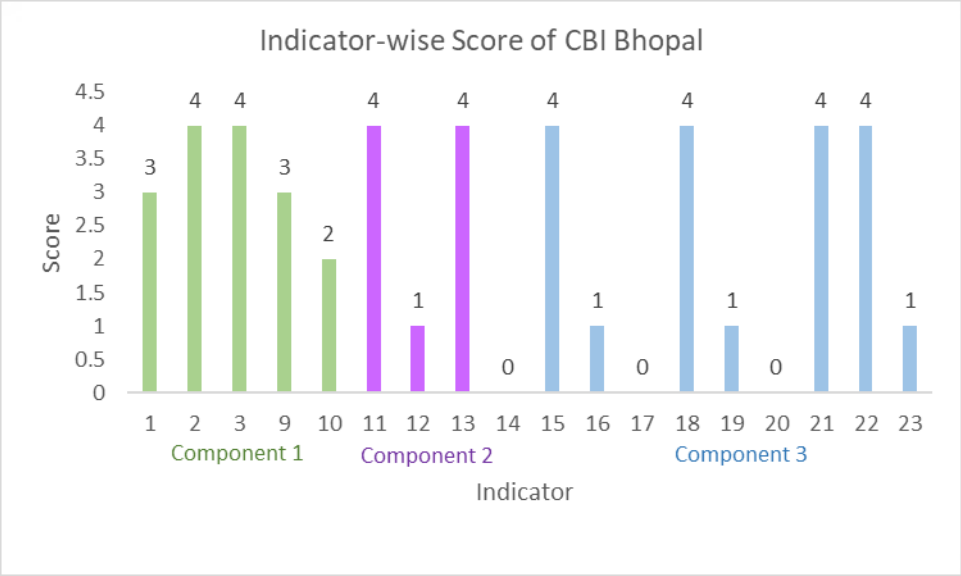


Figure 1: Bhopal City Biodiversity Index at a glance

INDICATOR WISE SUMMARY SCORE OF

CITY BIODIVERSITY INDEX- BHOPAL

Table 1: Indicator-wise score of City Biodiversity Index- Bhopal

23 Indicators of City Biodiversity Index	Maximum Score	Score obtained for Bhopal City
Component – Native Biodiversity		
1. Proportion of Natural Areas in the City	4 points	3 points
2. Connectivity Measures	4 points	4 points
3. Native Biodiversity in Built Up Areas (Bird Species)	4 points	4 points
4. Change in Number of Vascular Plant Species	4 points	NA
5. Change in Number of Bird Species	4 points	NA
6. Change in Number of Freshwater fish Species	4 points	NA
7. Change in Number of Species (Odonates)	4 points	NA
8. Change in Number of Species (Amphibians)	4 points	NA
9. Proportion of Protected Natural Areas	4 points	3 points
10. Proportion of Invasive Alien Species	4 points	2 points
Component – Ecosystem Services Provided by Biodiversity		
11. Regulation of Quantity of Water	4 points	4 points
12. Climate Regulation: Carbon Storage and Cooling Effect of Vegetation	4 points	1 point
13. Recreation and Education: Area of Parks with Natural Areas	4 points	4 point
14. Recreation and Education:Number of Formal Education Visits per Child Below 16 Years to Parks with Natural Areas per Year	4 points	0 point
Component – Governance and Management of Biodiversity		
15. Budget Allocated to Biodiversity	4 points	4 points
16. Number of Biodiversity Projects Implemented by the City Annually	4 points	1 point
17. Existence of Local Biodiversity Strategy and Action Plan	4 points	0 point
18. Institutional Capacity: Number of Biodiversity Related Function	4 points	4 points
19. Institutional Capacity: Number of City or Local Government Agencies Involved in Inter-agency Cooperation Pertaining to Biodiversity Matters	4 points	1 point
20. Participation and Partnership: Existence of Formal or Informal Public Consultation Process	4 points	0 point
21. Participation and Partnership: Number of Agencies/Private Companies/NGOs/ Academic Institutions/International Organisations with which the City is Partnering in Biodiversity Activities, Projects and Programmes	4 points	4 points
22. Education and Awareness: Is Biodiversity or Nature Awareness Included in the School Curriculum	4 points	4 points
23. Education and Awareness: Number of Outreach or Public Awareness Events Held in the City per Year	4 points	1 point
Component – Native Biodiversity in the City (Sub-total for indicators 1-10)*		**16/ 20 points***
Component – Ecosystem Services provided by Biodiversity (Sub-total for indicators 11-14)		**9 / 16 points**
Component – Governance and Management of Biodiversity (Sub-total for indicators 15-23)		**19 / 36 points**
Total		**44 / 72 points**

* 5 indicators (Indicator 4-8) are not calculated as this is the first application of City Biodiversity Index, and species changes can thus not be noted.

SECTION I
About City Biodiversity Index

Acknowledging the role that cities and local bodies play in the implementation of a Madhya Pradesh State Biodiversity Strategy and Action Plan (MP-SBSAP), an index, the City Biodiversity Index (CBI), which would measure biodiversity in urban areas was developed.

CBI was developed and maintained by the Singapore National Parks Department (NParks) in 2010, with support from ICLEI, the CBD and others, the CBI is the only biodiversity index designed specifically for monitoring and evaluating biodiversity in cities. The index is also called the 'Singapore Index (SI)' in recognition of Singapore's contribution and leadership.

The CBI is a self-assessment tool for cities to evaluate and monitor the progress of their biodiversity conservation efforts against their own individual baselines. It comprises: a) the "Profile of the City", which provides background information on the city; and b) the 23 indicators that measure native biodiversity, ecosystem services provided by biodiversity, and governance and management of biodiversity based on guidelines and methodology provided in the User's Manual on the Singapore Index on Cities' Biodiversity (User manual CBI, 2014).

According to the Secretariat of the Convention on Biological Diversity (CBD, 2020), some of the benefits that cities derived from the application of the index include "a) the process facilitated capacity-building in biodiversity conservation, b) the indicators also function as biodiversity conservation guidelines, and c) assistance in setting priorities for conservation actions and budget allocation through quantitative scoring".

The CBI scoring is quantitative in nature. A total of 23 indicators make up the index, measuring a city's native biodiversity, the ecosystem services provided and biodiversity governance. Scores range between zero to four points for each indicator, with a maximum overall score of 92. The index is meant to allow the city to visualize their progress in conserving biodiversity with every application of the index. The first year is considered the baseline against which cities can then chart their subsequent progress.

The CBI is divided into 2 parts:

Part I - Profile of the city- Location, physical features, demographics, administration, economic parameters etc.

Part II-	Nativebiodiversity in City	10*	40#
	Ecosystem services provided by biodiversity in the city	4*	16#
	Governance and Management ofbiodiversity	9*	36#
	Total number of indicators and score	23*	92#

* Number of Indicators , # Maximum points

SECTION II
City Biodiversity Index of Bhopal

Part A: Bhopal City Profile

1. Location

Bhopal, the capital of Madhya Pradesh, is also known as the city of lakes, due to the presence of several natural and artificial lakes. It is located in central India and lies between latitudes 23°07'N–23°54'N, and longitudes 77°12'E–77°40'E, just north of the upper limit of the Vindhya Mountain ranges. The two main lakes in the city, namely the upper lake and lower lake, have an area of 38.72 km^2 and 1.29 km^2 and a catchment area of 361 km^2 and 9.6 km^2, respectively.

2. Geographical Characteristic

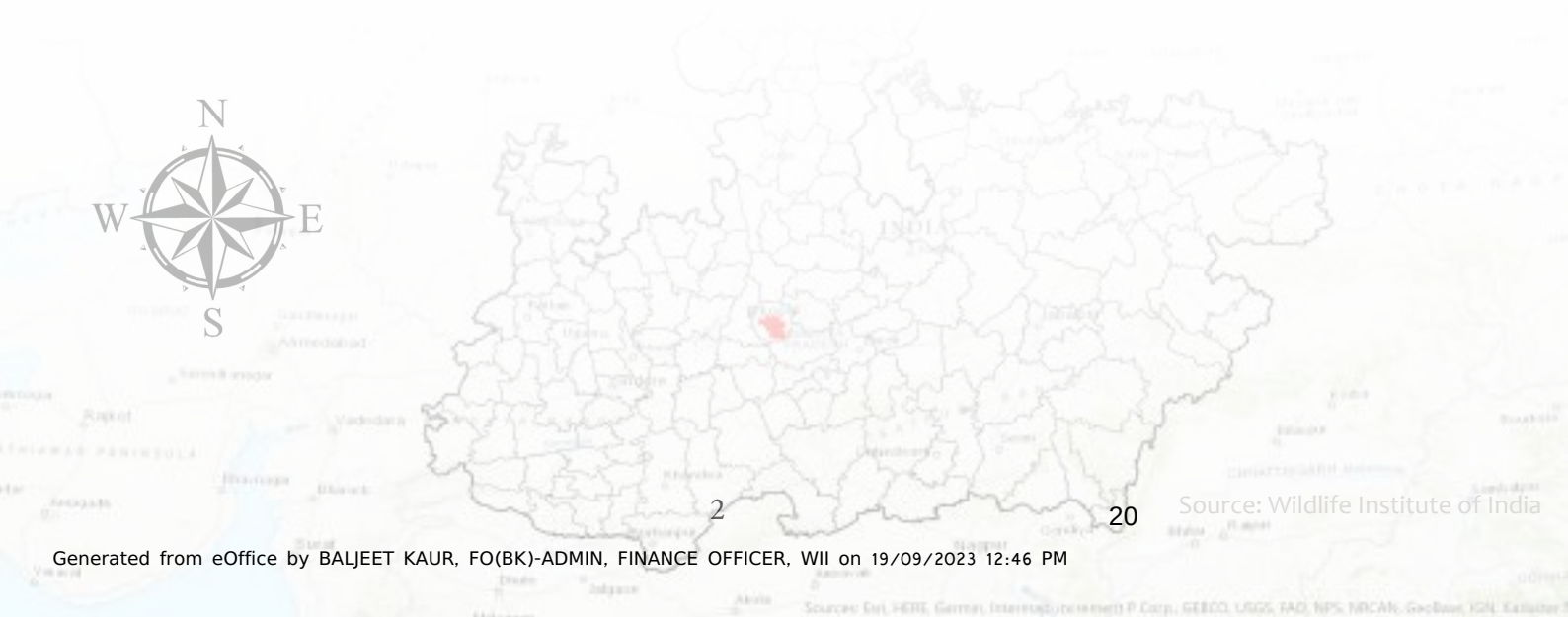
The city stands at an average elevation of 500 meters, dotted with small hills within its boundary (Ghosh, 2019; Ali and Patnaik, 2019). The prominent hills in Bhopal are Idgah hills and Shyamala hills in the northern region and Katara hills in the southern region.

Bhopal experiences a humid subtropical climate. The average temperature is about 30°C, during the summer season (March to June), while during the winter season, which begins from October to January, daily temperatures average around 16°C. The rainy season is between June to September with a total annual rainfall of about 1,146 mm (46 inches) (Ali and Patnaik, 2019).

3. Demography

In terms of population size, Bhopal is the sixteenth largest city of India and the second most populated city in Madhya Pradesh (Nakamura et al., 2004). Bhopal Municipal Corporation is the urban local body that oversees all the matters pertaining to city governance with a jurisdiction overseeing 19 municipal corporation zones and 85 wards (**Figure 2** and list of Wards with area given in **Table 2**), covering an area of 411 km^2.

According to the census 2011, the city's population is 1,798,218, with 936,168 males and 862,050 females, with a population density of 6,920 and a literacy rate of 83.47% (Census, 2011).



Source: Wildlife Institute of India

4. Economy

According to the Unit Level Data of the National Sample Survey Organization (NSSO), the Urban Poverty Ratio of Bhopal city (% of urban population) is 9.72, and Unemployment Rate (2011-12) is 1.53% (National Sample Survey, 2012). On the basis of the statistics presented by the National Sample Survey 2011-2012 (Districts of India, 2022), the majority of the workforce is engaged in the tertiary sector.

Due to the large number of small and medium-sized industries in Bhopal, it has a robust industrial base. As a result, the district's economy is mostly based on industry. The highest-profit-making public-sector company in India is Bharat Heavy Electrical Ltd (BHEL), which has a unit in Bhopal. In Bhopal and the surrounding areas, BHEL, a significant producer of electrical equipment, provides a significant source of employment (Districts of India, 2022). BHEL occupies a significant area in the eastern part of the city (BHEL, 2022). Leading Indian media organizations like the Dainik Bhaskar Group have their headquarters in Bhopal. Manufacturing of matchsticks is the well-known cottage industry in the city of Bhopal.

Bhopal houses several national and sub-national research institutes. Some prominent ones are, Council of Scientific and Industrial Research–Advanced Materials and Process Research (CSIR–AMPR), Indian Institute of Science Education and Research (IISER), All India Institute of Medical Sciences (AIIMS), Maulana Azad National Institute of Technology Bhopal (MANIT), Indian Institute of Forest Management (IIFM), National Institute of Fashion Technology (NIFT), National Institute of Design (NID).

5. Biodiversity

The city of Bhopal is rich in flora and fauna. Numerous lakes and dams give the city a unique identity in the Central Indian landscape. The Natural Asset Map of Bhopal, developed under this project, highlights its various blue-green ecosystems, such as the water bodies (lakes and ponds), canals, which support a wide area of agricultural land, forests, dense vegetation, and avenue plantations. The city also has several parks which support recreational activities (refer **Figure 3 and Table 3** for details on the land classes and the area occupied by each of them).

The Van Vihar National Park (VVNP) and Zoo supports a wide diversity of flora and fauna under the Ministry of Environment, Forest and Climate Change and Central Zoo Authority, Govt. of India. It also serves as a rescue center for wild animals that are unfit to be released in the wild. The Zoo helps to generate awareness among the citizens on the significance of wildlife and the need to conserve the same.

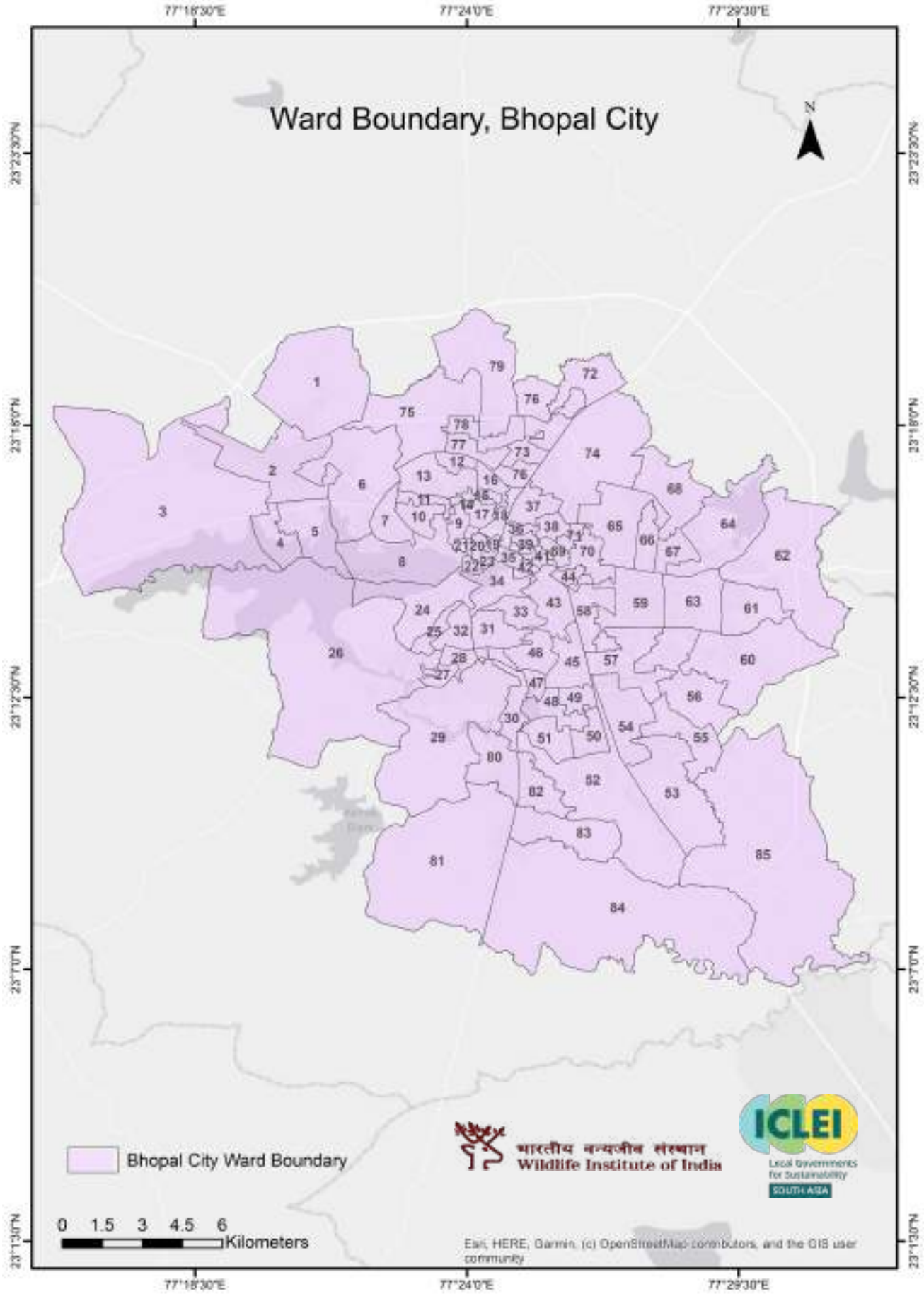


Figure 2: Ward Boundaries of Bhopal City

Table 2: List of Wards, Bhopal Municipal Coorporation

Ward Number	Ward Name
1	Mahatma Gandhi
2	Airport
3	Bhouri ward
4	Hemukalani
5	Sadhu Vaswani
6	Mahavir Giri
7	Koh-E-Fiza
8	Royal Market
9	Baghmunsihusain Khan
10	Idgah hills
11	Babu Jagjivan Ram
12	Nariyalkheda
13	Geetanjali
14	Shahjanabad
15	J.P. Nagar
16	Motilal Nehru
17	Ibrahim Ganj
18	Ram Mandir
19	Lal Bahadur Shastri
20	Mahavir Swami
21	Jain Mandir
22	Moti Masjid
23	Islampura
24	Rani Kamlapati
25	Swami Vivekanand
26	Dr. Ambedkar
27	Goswami Tulsidas
28	Rani Awanti Bai
29	Maulana Abdul Kalam Azad
30	Kusa Bhau Thakre
31	Chhatrapati Shivaji
32	Jawahar Lal Nehru
33	Pt. Madanmohan Malviya
34	Rabindranath Tagore
35	Jahangirabad
36	Chandbad
37	Kapda Mill
38	Semra
39	Navin Nagar
40	Aish Bagh
41	Bagh Farat Afza
42	Maharani Laxmibai
43	Maharana Pratap
44	Subhas Chandra Bose
45	Indira Gandhi

Ward Number	Ward Name
46	Pt. Ravishankar Shukla
47	Dr. Rajendra Prasad
48	Arera Colony
49	Asha Niketan
50	Gulmohar
51	Shahpura
52	Misrod
53	Jatkhedi
54	Barkatullah
55	Bagmugalia
56	Berkheda Pathani
57	Saket-Shakti Nagar
58	Kasturba Nagar
59	Berkheda (BHEL)
60	Govindpura
61	Khajuri Kalan
62	Hatai Kheda
63	Gautam Budh Nagar
64	Sonagiri
65	Govindpura industrial area
66	Narela Shankari
67	Indrapuri
68	Ayodhya Nagar
69	Guru Nanakdev
70	Punjabi Bagh
71	Dusshera Maidan-Ashoka Garden
72	Rajiv Gandhi
73	Bhopal Memorial Hospital
74	Bhanpur
75	Badwai
76	Chhola
77	Russeli
78	Karond
79	Navibagh
80	Sarvadharam
81	Khanha Kunj
82	Danish Kunj
83	Sankhedi
84	Ratanpur Sadak
85	Katara

In addition to the caged animal species, there are several species of birds, butterflies and some mammals such as the Sambar *Rusa unicolor*, Chital *Axis axis*, Nilgai *Boselaphus tragocamelus*, Blackbuck *Antilope cervicapra*, Gray Langur *Semnopithecus sp*. which are found free ranging in the premises of VVNP.

Fourteen city forests are present within Bhopal. Of these, Laharpura City Forest and Samardha City Forest, are managed by Madhya Pradesh Forest Department while the rest are managed by the Capital Project Authority (CPA). The area of all these city forests is provided in **Table 5**.

The Bhoj Wetlands, which comprise the upper and lower lake, is a designated Ramsar Wetland Site, since 2002. The wetlands cover an area of 32.01 sq km and are located at 23°14'N and 077°20'E (Ramsar Convention, 2002). These lakes are artificial. The upper lake was constructed in the 11th centuary by Raja Bhoj (Tamot and Awasthi, 2010) and the lower lake was built around 200 years ago by Nawab Chhote Khan . The wetland is regarded as a biodiversity hotspot as supports a significant diversity of phytoplankton, zooplankton (Neelam et al., 2009), macrophytes, wild and cultured fish in the upper lake. The wetland is an important habitat for various endangered residents and migratory birds as well (Tamot and Awasthi, 2010). There are 18 water reservoirs present in the city, including the Bhoj Wetland.

Flora:

Biswal (2019) reported 791 species of plants belonging to 510 genera and 28 families from Bhopal. He also reported 178 species of macrophytes belonging to 60 genera and 70 families16 from Bhoj Wetland. Agarwal and Varma (2012) conducted a study in Bhopal district and documented 79 ethnomedicinal plant species. For the present study and for calculation of index, a list of 488 vascular plant species has been referred and reported from Bhopal, after verification from plant taxonomists (**Annexure III, Table 12**). In addition to this a list of 97 Invasive Alien Plant Species have been reported from Bhopal (Khan, 2018) (**Annexure III, Table 17**).

Fauna:

Butterflies and birds are the major faunal taxa that have been studied predominantly in the city. Based on available data, checklists of different taxa have been prepared. A total of 106 species of birds were recorded from IIFM campus in 2015 (Agarwal et al., 2015). The checklist of birds has been prepared from different sources (ebird; Rajbir and Khalique, 2020; MPSBB, 2016). A list 266 bird species reported from Van Vihar National Park. A total of 274 species of birds are listed from the city, among which 108 numbers of species occur in the urban area (built-up) area of the city (**Table 11, Annexure - III**), as verified by Mr. Ankit Chaturvedi- a taxa expert from The Nature Volunteers.

Barkatullah University campus is rich in biodiversity which has been well documented. Spread across an area of 350 acres, the campus supports more than 50 species of trees, 46 bird species, 24 butterfly and 26 odonate species. However, for the present study, after verification from experts, a total of 23 Odonate species have been reported from Bhopal (**Table 16, Annexure III**).

A study carried out on the butterfly diversity around the Kerwa reservoir reported 18 species of butterflies (Mishra et al., 2014), while a campus survey of butterflies in IIFM and Barkatullah University reported 55 species (Harsh, 2014) and 12 species respectively. Van Vihar National Park hosts 63 species of butterflies (Rajgir and Khalique, 2022). Dr Yogesh Dubey, IIFM was consulted to verify the butterfly list of the city. A butterfly survey was conducted in the Ratapani Wildlife Sanctuary, situated at 65 kms from the city, reported 104 species of butterflies. An overall list of 85 butterfly species have been reported in Bhopal city from various sources are used for calculation of indicators (**Table 13, Annexure - III**).

Due to the presence of various reservoirs, marshy lands, and dams, a wide reptilian diversity flourishes in the city. A comprehensive analysis based on secondary literature (Chandra et al., 2007; Wani and Saify, 2013; Manhas et al., 2015; Manhas et al., 2016) has yielded a list of 36 herpetofauna species, including various snakes, lizards, turtles, Gharial, and Mugger crocodile (**Table 14, Annexure - III**).

The city's numerous lakes, predominantly the Bhoj Wetlands, host a wide variety of migratory birds and aquatic fauna. A list of 37 fish species have been reported from the Upper Lake (Ramsar Covention, 2022) and 53 species of fishes from Bhoj Wetland. An overall list of 44 species of Fishes have been reported from Bhopal city from various sources (**Table 15**).

6. Natural Asset Map:

The natural areas of Bhopal city, that fall under the jurisdiction of Bhopal Municipal Corporation have been mapped on the GIS platform (**Figure 3**). A total of 12 land classes have been identified in the city. **Table 3** provides details of the area under each natural asset class. Additional details have been provided in **Annexure - I**.

Table 3: Bhopal Municipal Coorporation Natural Asset Area-wise Distribution

S. No.	Class	Area (sq. km)	Area (ha)	% Area
1	Forest / Natural vegetation	21.99	2199	5.35
2	Open scrub	9.25	925	2.25
3	Sparse vegetation	14.44	1444	3.51
4	Marshes	10.13	1013	2.46
5	Open Green Spaces	6.37	637	1.54
6	Lakes and ponds	31.23	3123	7.59
7	River / Drainage	3.37	337	0.82
8	Riverine	0.35	35	0.08
9	Open ground	4.82	482	1.17
10	Tree patch and plantation	21.32	2132	5.18
11	Agriculture	147.58	14758	35.90
12	Fallow Land	0.40	40	0.09
	TOTAL	**271.25**	**27125**	**65.94**

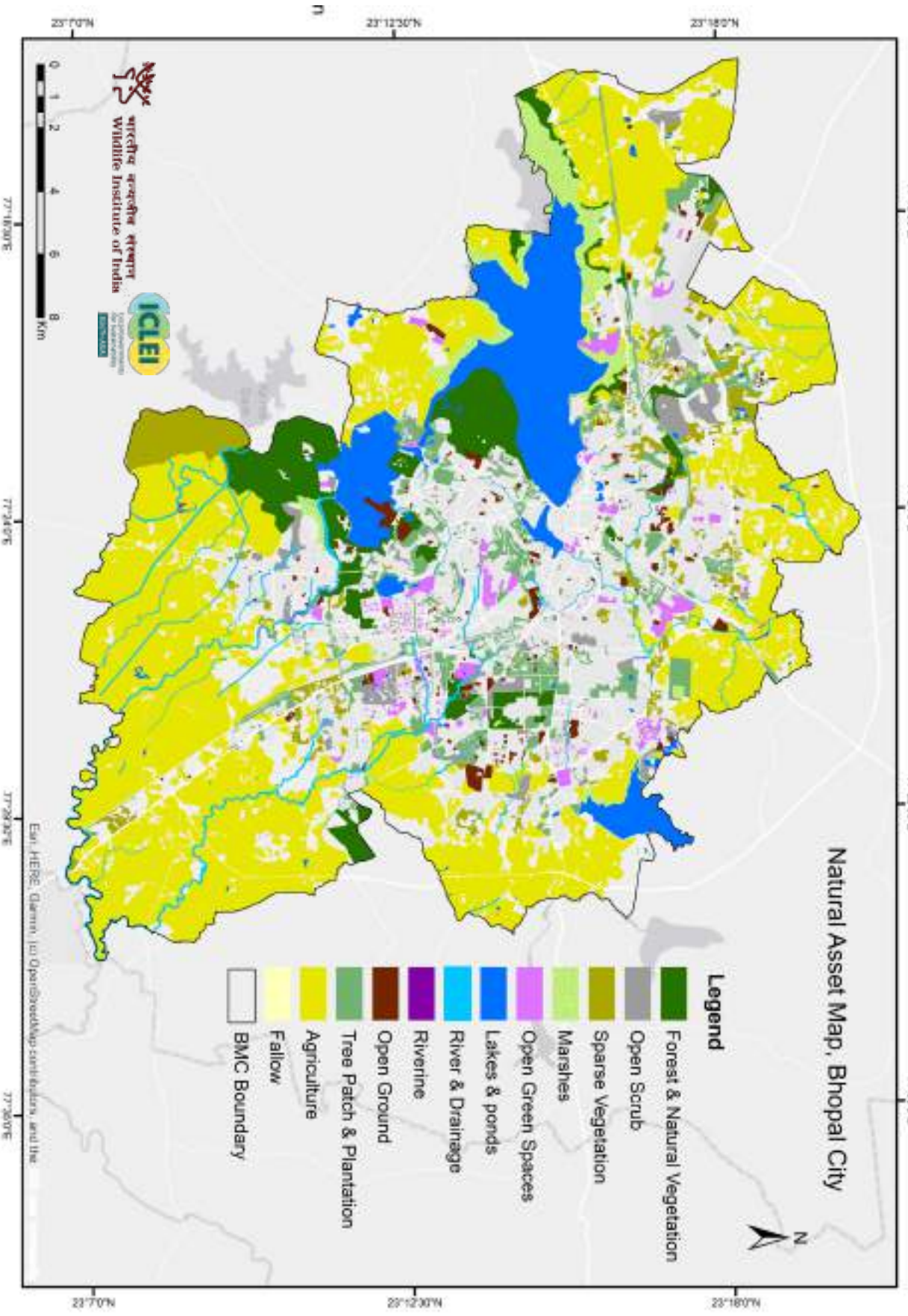


Figure 3: Natural Asset Map of Bhopal city

7. Administration of Biodiversity

State driven conservation models include protected areas and territorial forests (Krishnan et al., 2012). Bhopal city has protected areas, city forests/territorial forests which are maintained by the Madhya Pradesh Forest Department.

In Bhopal, the following agencies are responsible at state and city administrative level for biodiversity related activities.

i. Madhya Pradesh Forest Department:

This State level department, established in 1860, manages forest lands, conserving forest resources, wildlife and overall biodiversity through administrative entities established at the regional level (M.P. Forest Department, 2022). Van Vihar National Park and other natural areas are managed by this Department. For more details please visit: https://mpforest.gov.in/HomeHindi.aspx

ii. Bhopal Municipal Corporation (Bhopal Nagar Nigam):

Bhopal Municipal Corporation is responsible for the day-to-day administration of municipal activities and services, within the city. While the Municipal Corporation looks into urban services like water supply, solid waste management etc, it is also responsible for management of blue-green spaces that fall within its jurisdiction limit. For more details, please visit: http://www.bhopalmunicipal.com/city-information/about-bhopal.html

iii. Madhya Pradesh State Biodiversity Authority (MPSBB):

Headquartered in Bhopal, MPSBB advises the State Government and the local bodies on issues pertaining to biodiversity conservation, including constituting local biodiversity management committees, conducting regular training programmes and consultations and awareness on issues pertaining to biodiversity. MPSBB has also developed the People's Biodiversity Register of Bhopal Municipal Corporation. MPSBB prepared an important document for biodoiversity management, the MP State Biodiversity Strategy and Action Plan (MP-SBSAP) 2018-2030. For more details please refer http://mpsbb.nic.in/

iv. Bhopal Smart City Development Corporation Limited:

The Government of India selected Bhopal city as one of the smart cities under the National Smart Cities Mission. The mission aims to develop smart cities across the country, making them citizen-friendly and environmentally sustainable, with adequate blue-green spaces. Under the Companies Act 2013, the Bhopal Smart City Development Corporation Limited (BSCDCL) was established on 14th March 2016. BSCDCL is owned by the Government of Madhya Pradesh. For more details please refer https://smartbhopal.city/

v. Environmental Planning & Coordination Organization (EPCO), Bhopal:

EPCO, which falls under the jurisdiction of the Urban Development and Environment Department of the State undertakes research and implementation projects. In Bhopal city, EPCO collaborates with the Municipal Corporation and various NGOs, to develop outputs such as the Bhoj-Wetland Bhopal Conservation & Management Plan. For more details please refer https://www.epco.mp.gov.in/

vi. Central Zoo Authority:

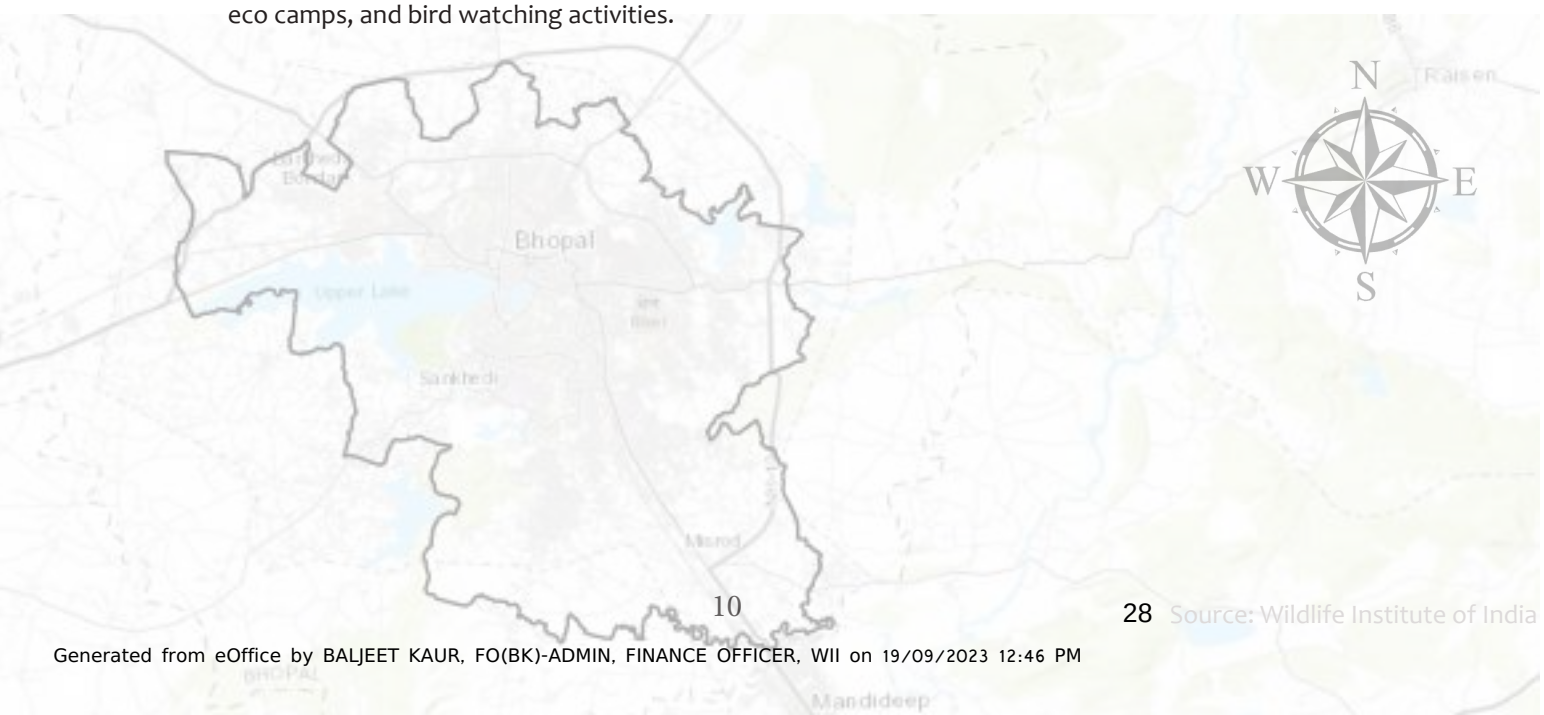
The Central Zoo Authority is a National level Government Authority, that manages the VVNP, Zoological Garden, Rescue center for Wildlife and a Conservation Breeding Centre. Van Vihar has a Snake and Butterfly interpretation center, open to the general public and Rescue and breeding centers, i.e., Bear Rescue Centre, Vulture Conservation Breeding Centre, and the Hardground Swamp deer (Barasingha) Breeding Centre. The Zoo Authority also organizes various educational and awareness activities throughout the year. For more details please refer https://vanviharnationalpark.org/

vii. Capital Project Authority (CPA):

The CPA is administered by the Housing & Environment Department of the State, with a separate forest division which undertakes the maintenance of parks and gardens that fall under its jurisdiction (refer to **Table 18 of Annexure - IV**). It also undertakes plantations in green spaces in the city as well as the roadside plantations. For more details please refer https://cpamp.nic.in/

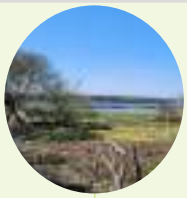
viii. Madhya Pradesh Ecotourism Development Board (MPEDB):

An autonomous organisation of the Madhya Pradesh Forest Department; MPEDB was established in July 2005. The Board is known for organizing Anubhooti Nature Camps in the State, including in Bhopal City. The goal of Anubhooti nature camps is to expose and educate students about forests and biodiversity, by taking them for a visit to nearby national parks or any natural area. MPEDB assists the M.P. Forest Department with the necessary technical and skill support and policy initiatives around livelihood development, capacity building of officials, eco camps, and bird watching activities.



 Source: Wildlife Institute of India

Part B: Indicators of the City Biodiversity Index



INDICATOR 1: Proportion of Natural Areas in the city

The definition given in the CBI user manual was followed as closely as possible, given Indian conditions, and the Natural Asset map (**Figure 3**) was referred while calculating the Proportion of Natural Areas. **Table 3** enlists all the land classes and their area. Twelve land classes that were taken into account are, Forest/ Natural vegetation, Open Scrub, Sparse vegetation, Marshes, Open Green Spaces, Lakes and ponds, River/ Drainage, Riverine, Open ground, Tree patch and plantation, Agriculture, Fallow land.

As per the CBI User Manual, Principle for calculation of the indicator is
(Total area of natural, restored and naturalised areas) ÷ (Total area of city) × 100

Scoring Range: (based on the CBI user manual)
0 point: <1.0%
1 point: 1.0% - 6.9%
2 points: 7.0% - 13.9%
3 points: 14.0% - 20.0%
4 points: > 20.0%

To calculate the proportion of the natural areas the land classes considered are: Forest/ Natural vegetation, Open Scrub, Lake, Marshes, River, Riverine and Open Green Spaces with Natural Vegetation (**Table 4**).

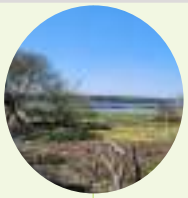
Table 4: Natural Areas that were used to calculate Indicator 1

S.No	Land Class	Area in sq km	Area in ha
1	Forest / Natural vegetation	21.99	2199
2	Open scrub	9.25	925
3	Lake	31.23	3123
4	Marshes	10.13	1013
5	River	3.16	316
6	Riverine	0.35	35
7	Open green spaces with natural vegetation	2.89	289
	Total	**79**	**7900**

Principal for calculating the indicator:
(Total area of natural, restored and naturalized areas) ÷ (Total area of city) × 100

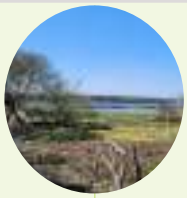
Total area of natural, restored and naturalized areas: 79 sq. km
Total area of city: 411 sq. km
Proportion of natural areas in city = 79 ÷ 411 × 100 = 19.2 %

RESULT: 19.2 % **SCORE: 3**



Recommendations to improve score

Bhopal scores well in this indicator because of its wetlands, which contribute to 57% of the natural area. The city appears to have sufficiently maintained its natural vegetation as well, which is the next highest contribution to the overall score. In order to enhance the score in the future application of the index, there needs to be a focus on actions that can improve the quality of blue-green networks while simultaneously increasing area. To do this, the city would benefit from the development of a Local Biodiversity Strategy and Action Plan (LBSAP), which would also ensure inclusion and greater participation of the Bhopal Municipal Corporation in biodiversity administration. Bhopal Municipal Corporation can seek technical expertise from Madhya Pradesh State Biodiversity Board for developing the LBSAP.



INDICATOR 2: Connectivity Measures or Ecological Networks to Counter Fragmentation

The patches associated with the land classes used to calculate indicator 1 i.e., forest/ natural vegetation, open scrub, lake, marshes, river, riverine and open green spaces with natural vegetation. In reality, landscapes represented in Bhopal Municipal Corporation by the land classes- Agriculture, fallow land, tree patches, plantation and open ground also form a part of the ecological network. However, these have not been considered following the guidelines of the CBI manual.

As per the CBI user manual

Principle for calculation of the indicator

$$\frac{1}{A_{total}} * \left(A_1^2 + A_2^2 + A_3^2 + \ldots + A_n^2\right)$$

Where:

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. more than or equal to 100m apart)

$_n$ is the total number of connected natural areas

This measures effective mesh size of the natural areas in the city. 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.

Scoring Range: (based on the CBI user manual)

0 point: < 200 ha
1 point: 201 - 500 ha
2 points: 501 - 1000 ha
3 points: 1001 - 1500 ha
4 points: > 1500 ha

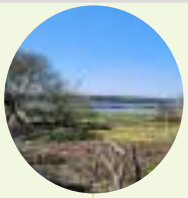
217 polygons (patches) were merged with the land class lake and river and considered a single unit, as per the 100m proximity rule. Therefore, the total area of this big patch (A1) was determined as 6133.27 ha (refer to **Annexure II, Table 10**). There are 221 polygons (patches) which are outside the 100m buffer of this big patch. As per the 100m proximity rule, these 221 patches are inter-merged into 88 patches (A_2 – A_{89}). The total number of patches is as shown in **Table 10, Figure 4**.

A_{total} = 7891.86 ha

As per the final calculation

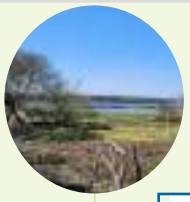
Indicator 2 = 1/7891.86 ha × (38017816.2 ha^2) = 4817.35 ha

RESULT: 4187.35 ha **SCORE: 4**



Recommendations to improve score

Once again, the city scores high, primarily because of its aquatic network. An examination of the Natural Asset Map (**Figure 3**) indicates a highly connective network of ecosystems on the east of the city where the Bhoj Wetlands and associated forests are found. There is also a high proportion of agricultural fields on the west side of the city, which although has not been considered for the purpose of this indicator's calculation, would also contribute to a connectivity network for biodiversity and ecosystem services. It would be beneficial for authorities to focus their efforts on rewilding or restoring land located in the west side in Bhopal, through the creation of native-species dominanted parks, a shift towards agroforestry practices in agricultural areas and so on. The planning for these types of interventions can be routed through the LBSAP development.



Component: Native Biodiversity

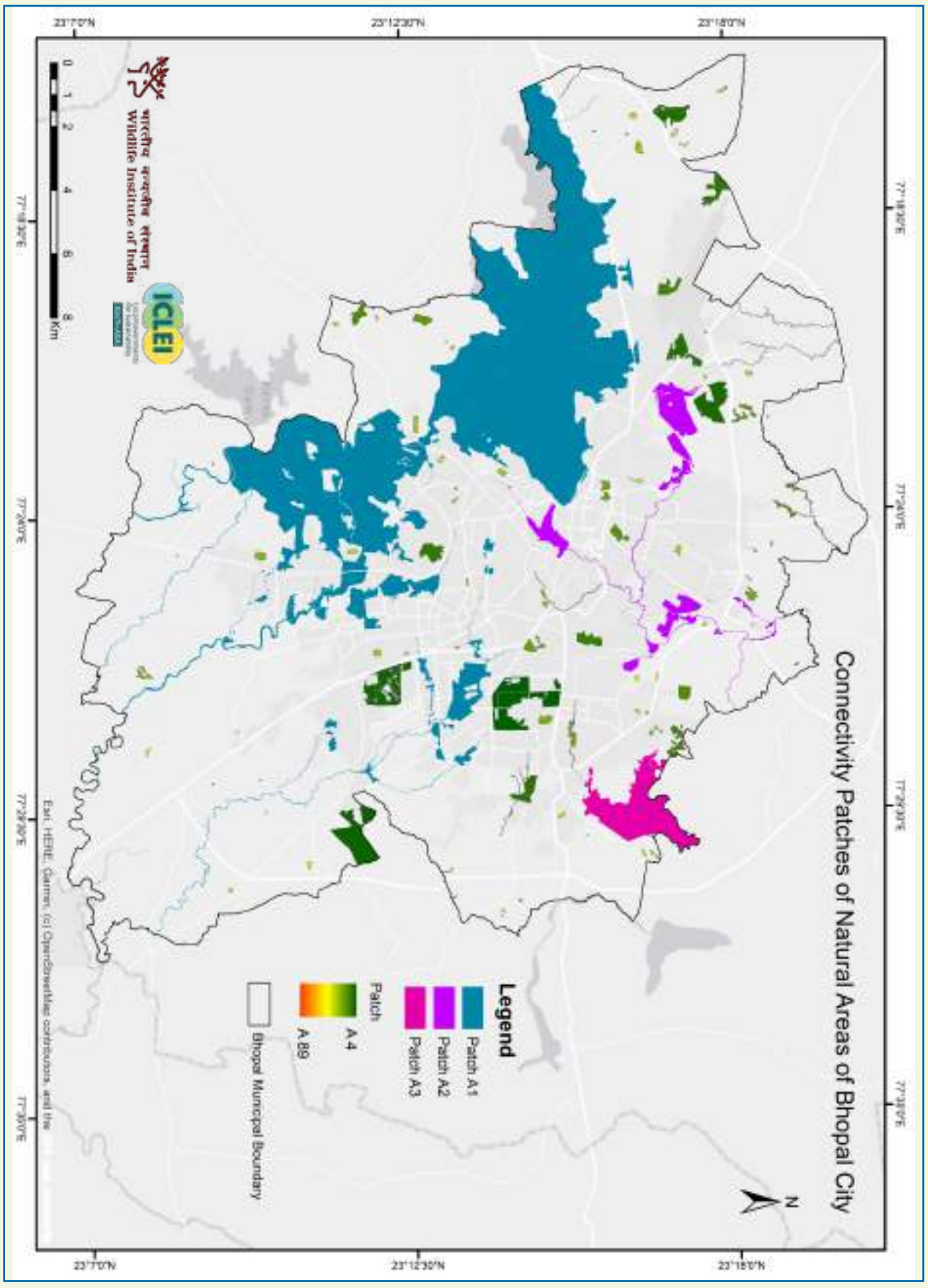
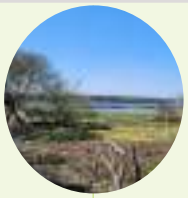


Figure 4: Connectivity Patches of natural areas of Bhopal City



INDICATOR 3: Native Biodiversity in Built up Areas (Bird Species)

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.

Scoring Range: (based on the CBI user manual)

0 point:	< 19 bird species
1 point:	19 - 27 bird species
2 points:	28 - 46 bird species
3 points:	47 - 68 bird species
4 points:	> 68 bird species

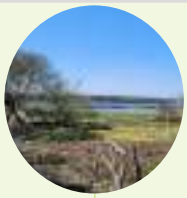
To calculate indicator 3, an extensive list of birds were prepared, using data from different sources (Aggarwal et al., 2015; MPSBB, 2016). Birds from this list were then categorised into those that were observed in urban spaces and those limited to more natural spaces. This 274 list was then vetted by bird expert, Mr. Ankit Chaturvedi from The Nature Volunteers (TNV) (refer **Table 11 of Annexure - III**).

The total number of species that occur in the anthropogenic spaces of Bhopal city are 108.

RESULT: 108 bird species **SCORE: 4**

Recommendations to maintain score

Blue-green spaces such as urban parks, agricultural fields, home gardens, plantation across the roadside, and artificial lakes provide important habitat for birds, in addition to natural areas. While Bhopal scores well under this indicator, the quality of these spaces can always be improved. This can be done through direct interventions such as planting of more native species, wetland restoration, or through awareness generation which encourages citizen participation. The latter can be addressed by supporting citizen Science workshops and Seasonal bird watching through NGOs like Bhopal Birds, The Nature Volunteers. The Biodiversity Management Committee can play an active role in awareness generation and coordinating plantations by citizens and NGOs.



INDICATOR 4-8 : Change in Number of Native Species

The change in number of native species is used for indicators 4 to 8. The three 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 two other taxonomic groups for indicators 7 and 8 (e.g. bryophytes, fungi, amphibians, reptiles, freshwater fish, molluscs, dragonflies, beetles, spiders, hard corals, marine fish, seagrasses, sponges, etc.)

The above data from the first application of the City Biodiversity Index would be reported in Part A: Profile of the City as the baseline data.

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.

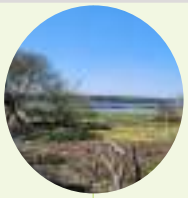
Scoring Range: (based on the CBI user manual)

0 point:	Maintaining or a decrease in the number of species
1 point:	1 species increase
2 points:	2 species increase
3 points:	3 species increase
4 points:	4 species or more increase

Data on native species was collected from different institutions and secondary literature.

As directed in CBI User Manual, for indicators 4, 5, and 6, the taxonomic groups were the vascular plants, birds, and butterflies (refer **Table 12, Table 11, Table 13 of Annexure - III**). The checklist for vascular plants was extracted from published documents (Modak, 2018; Wani and Saify, 2013) while for birds published literature (Aggarwal et al., 2015; MPSBB, 2016) and citizen's science platform (e-bird) was used. Various research papers were referred to prepare the checklist of butterflies (Chandra et al., 2007; Harsh, 2014; Mishra et al., 2014) For indicators 7 and 8, the selected taxonomic groups are reptiles and fishes, respectively (refer **Table 14, Table 15 of Annexure - III**). The list of reptiles was sourced from the research papers (Manhas et al., 2015; Manhas et al., 2016 ; Manhas et al., 2017). For indicator 8, the fish list was developed by referring to the publications in journals (Napit, 2012; Tamot and Awasthi, 2012).

RESULT: Since this is the baseline year for the species count, the city will not receive a score on the indicators 4-8 and it will be excluded from the overall calculations.



INDICATOR 9: Proportion of Protected Natural Areas

The city's urban space comprises of several pockets of protected area land. As described in Part 1 (Biodiversity section), VVNP and Zoo receive the highest protection in the region. The Capital Project Authority manages Bhopal's Revenue Forest (RF) and the city forests as listed in **Table 5** except the Laharpura city forest and Samardha city forest, which is managed by the Madhya Pradesh Forest Department. Additionally, the Bhoj Wetlands occupying 32.01 sq.km, a Ramsar site, also receives some form of protection, by the Ramsar convention.

Table 5: List of Protected Areas/secured natural areas

Name of the Protected Natural Area	Area (in sq.km)
1. Van Vihar National Park	4.4521
2. Samardha City Forest	0.5974
3. City Forest Laharpur, Forest Division Bhopal	1.00
4. Chichli RF	3.32387
5. Daulatpura RF	0.2342
6. Mahua Kheda RF	0.33228
7. Nayapura RF	0.53296
8. Bairagarh Chichli RF	0.25722
9. Shahpura City Forest	0.64616
10. Swarnajayanti Park	0.4218
11. AIIMS City Forest	0.0969
12. Jamuri Maidan City Forest	0.2170
13. Borvan City Forest	0.61
14. Guru Govind Singh City Forest	0.26
15. Dr. Shyamprasad Mukharji Park	0.18
16. Bhoj Vihar City Forest	0.0350
17. Priyadarshni City Forest	0.0250
18. Kanha Kunj City Forest	0.22
19. Nayapura Tekri City Forest	0.7918
20. Sardar Vallabh Bhai Patel Park	0.0350
Total area	**14.26869**

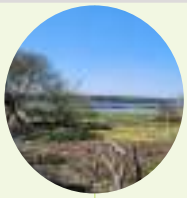
Scoring Range: (based on the CBI user manual)

0 point: < 1.4%
1 point: 1.4% - 7.3%
2 points: 7.4% - 11.1%
3 points: 11.2% - 19.4%
4 points: > 19.4%

(Area of protected or secured natural areas) ÷ (Total area of the city) × 100

Total Natural Protected Area - (14.27+32.01) = 46.28 sq. km

Total area of City - 411 sq. km



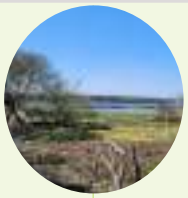
Component: Native Biodiversity

Proportion of protected natural areas = (46.28 ÷ 411) × 100 = 11.26 %

RESULT: 11.26 % **SCORE: 3**

Recommendations to improve score

The city scores average in this indicator and can be improved through protection provided to natural spaces. A detailed survey of natural areas can be done to identify biodiversity hotspots which can then be declared as Biodiversity Heritage Sites under the Biological Diversity Act 2002. As a first step, the city needs to constitute its Biodiversity Management Committee, followed by the development of an LBSAP which identifies partnerships that can contribute to hotspot identification.



INDICATOR 10 : Proportion of Invasive Alien Species

To calculate the score, the flowering plant taxa was selected. A study on the invasive alien species of Bhopal was referred to calculate this indicator. There are 173 invasive alien species in India, among which, 100 species are found in Bhopal city (Khan, 2018). These invasive species belong to 41 different families (refer **Table 17 of Annexure - III**).

Scoring Range: (based on the CBI user manual)

0 point:	> 30.0%
1 point:	20.1% - 30.0%
2 points:	11.1% - 20.0%
3 points:	1.0% - 11.0%
4 points:	< 1.0%

(Number of invasive alien species) ÷ (Number of native species) × 100

Number of Invasive Alien Species - 97

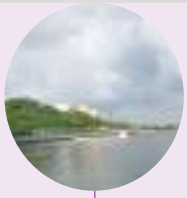
Number of Native Species- 488

Proportion of invasive alien species = (97 ÷ 488) × 100 = 19.8 %

RESULT: 19.8% **SCORE: 2**

Recommendations to improve score

According to literature, almost 20% of the city's flora is invasive, which indicates that the quality of the green cover may not be healthy. A detailed mapping of the presence and spread of the invasive plants needs to be undertaken. Risk assessment of the threats due to these invasive plants needs to carried out on priority basis. Bhopal Municipal Corporation should collaborate with the research institutions like IIFM to carry out research on invasive species, which can then inform effective mitigation actions through the LBSAP.



INDICATOR 11 : Regulation of Quantity of Water

A permeability map for the city was prepared in order to calculate this indicator (**Figure 5**). A supervised classification was done using sentinel images (Sentinel-2 Level, 2 products) with a cloud cover of less than 5% comprising the Bhopal city region (Tile Number - T43QGF) acquired on 28 October 2021, downloaded from USGS Earth Explorer. Land use classes of Paddy field, Plantation and other Agricultural lands, Waterbody, scrubland, Dense vegetation, Sparse vegetation, Open ground, Marshes, Paddy and Urban built-up were considered for the supervised classification process based on the standard methodology. After the LULC classification, the respective land classes were merged and a permeability map was prepared (**Figure 5**). **Table 6** classified the permeable and impermeable land classes in Bhopal city.

Table 6: Area of Permeable Spaces

Item/ Land Type	Area in ha
Permeable area including water bodies	31968.68
Impermeable	9117.90

(Total permeable area) ÷ (Total terrestrial area of the city) × 100

Scoring Range: (based on the CBI user manual)

0 point: < 33.1%
1 point: 33.1% - 39.7%
2 points: 39.8% - 64.2%
3 points: 64.3% - 75.0%
4 points: > 75.0%

Total permeable area = Permeable land area + Water body = 31968.68 ha

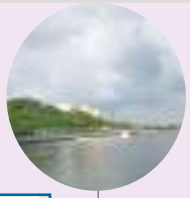
Total Terrestrial area = 37699.98 ha

Proportion of total permeable area = 31968.68 ÷ 37699.98 × 100 = 84.8 %

RESULT: 84.8 % **SCORE: 4**

Recommendations to maintain score

Bhopal's high score indicates that the percentage of built-up impermeable surfaces is low, allowing for water to percolate into the soil. Natural vegetation, agricultural fields and wetlands are the main reasons behind this high score. These spaces should be recognised for the water regulation services they provide, especially in future land use planning exercises. These spaces should be maintained in the present land use and diversion to any other land use class should be prohibited by the authorities.



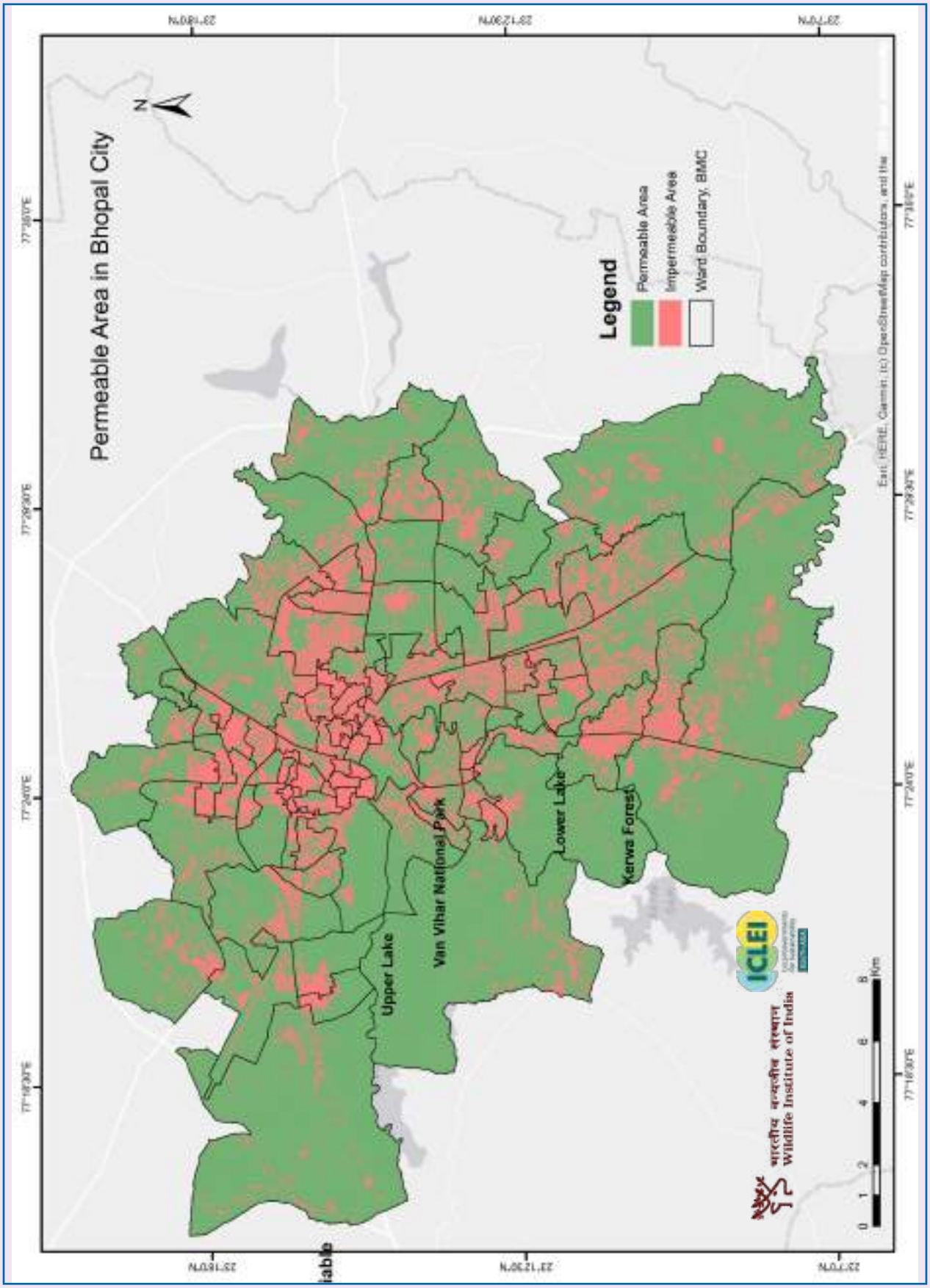
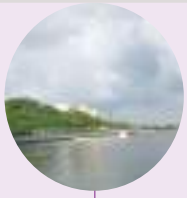


Figure 5: Permeable area map of Bhopal City



INDICATOR 12: Climate Regulation- Carbon Storage and Cooling Effect of Vegetation

In order to calculate indicator 12, a tree cover map (**Figure 6**) was generated using Sentinel satellite imagery (Sentinel-2 Level 2 products with a cloud cover of less than 5%). Red (R), Green (G), Blue (B), and Near Infrared (NIR) bands with 10m spatial resolution were pre-processed and used in the supervised classification process based on the standard methodology. The field surveyed location data for the tree cover area such as dense vegetation, Forest, Avenue tree patches and plantations were utilised as the training data set for the tree cover classification in ENVI 5.3 software. The tree cover map (**Figure 6**) was prepared by merging the respective land classes.

Tree cover = (Tree canopy cover) ÷ (Total terrestrial area of the city) × 100

Scoring Range: (based on the CBI user manual)

0 point:	< 10.5%
1 point:	10.5% - 19.1%
2 points:	19.2% - 29.0%
3 points:	29.1% - 59.7%
4 points:	> 59.7%

Tree canopy cover = 6232.59 ha

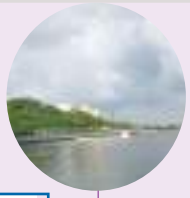
The total terrestrial area of the city = 377699.94 ha.

Tree cover = 6232.59 ÷ 377699.94 × 100 = 16.53 %

RESULT: 16.53% **SCORE: 1**

Recommendations to improve score

Although Bhopal scored high in indicators 1 and 2, the low score as per this indicator reinforces the fact that Bhopal's wetlands are major contributors to the city's high score. In terms of tree cover, Bhopal's forests and natural vegetation contribute the most to the score however, agricultural areas, which dominate a large portion of the western part of the city, limit it. To improve this score the city can look into encouraging agroforestry practices within these agricultural areas. Avenue plantations comprising of native species should also be promoted by the city. Species selection for the same can be carried out using the technical expertise of Madhya Pradesh State Biodiversity Board.



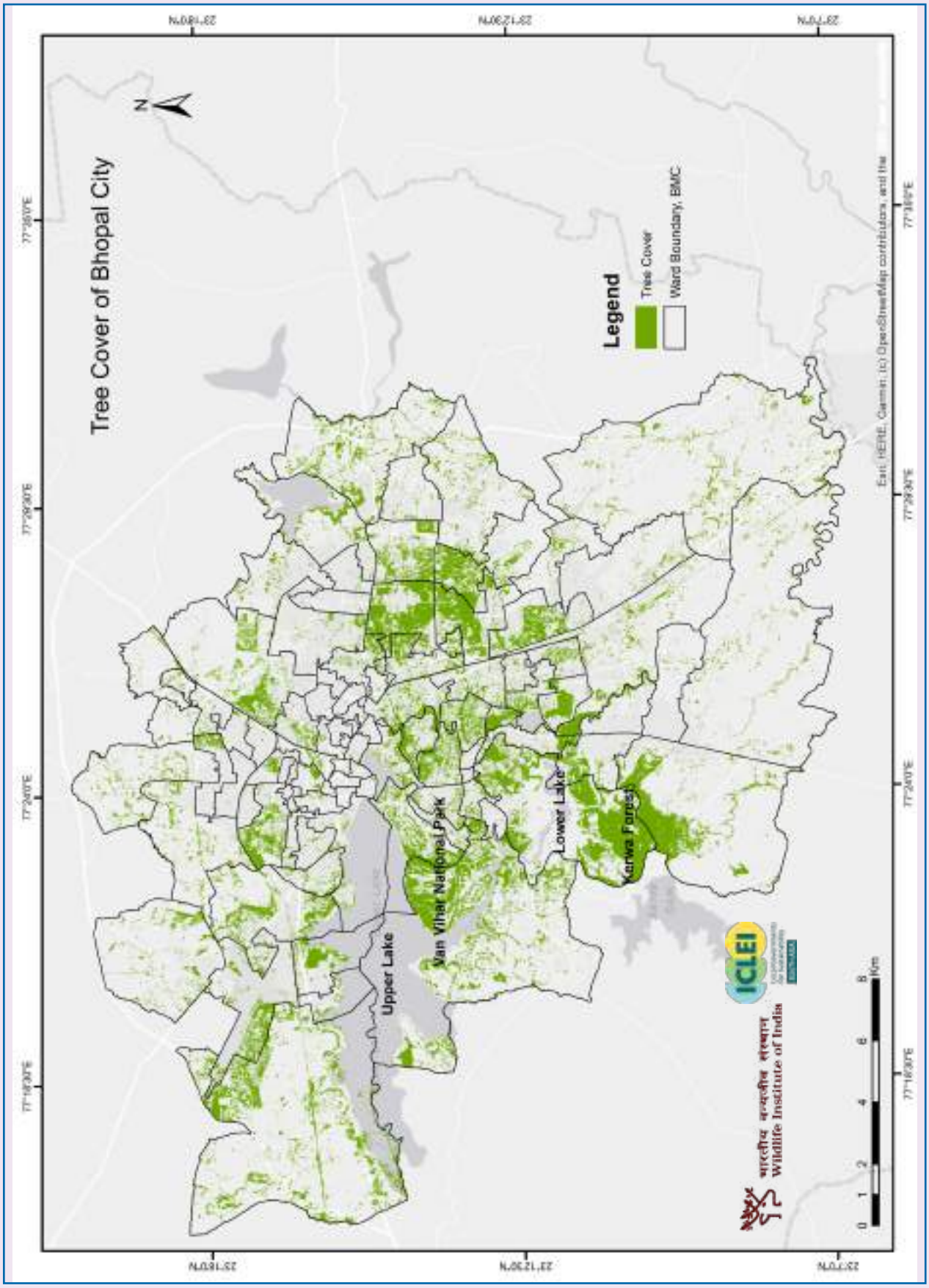
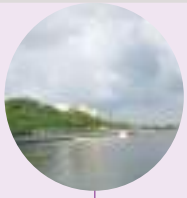


Figure 6: Tree Canopy Cover map of Bhopal City



INDICATOR 13 : Recreational Services

Parks in Bhopal are maintained by the Municipal Corporation and Capital Project Authority. To calculate this indicator, the list of parks maintained by these two agencies were collected (**Table 18 of Annexure - IV**).

The total area of parks is 2096.44 ha. VVNP covers an area of 445.21 ha, which has also been considered in the calculation. The park has a number of activities for tourists and the locals to avail, such as Safari, Biodiversity Interpretation Centre, Nature and Bird watching camps.

Area of parks with natural areas and protected or secured natural areas/ 1000 persons

Scoring Range: (based on the CBI user manual)

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

The total area of parks in the city is (2096.44 + 445.21) = 2541.65 ha

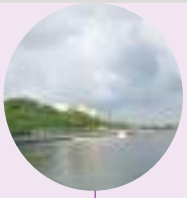
Area of recreational services for 1 person = Total recreational area/total population of city
= 2541.65 ÷ 17,98,218
= 0.00141 ha per person

Area of recreational services for 1000 person =
(Total recreational area ÷ total population of city) × 1000 = 1.41 ha per 1000 person

RESULT: 1.41 ha/1000 person **SCORE: 4**

Recommendations to improve score

The city has scored high in this indicator due to the high number of parks present in each ward in Bhopal. However, as reflected in the previous indicator, the tree cover of the city is low. In order to increase the same, the city can promote plantation of native tree species in appropriate areas in these parks. These parks and the plantations can be undertaken and maintained in collaboration with local NGOs. The city can also promote corporate support for the same through Corporate Social Responsibility funds.



INDICATOR 14 : Educational Services

There is an active participation of schools during the Wildlife Week Celebration in VVNP and in Anubhooti Nature Camps organized by the MPEDB and M.P. Forest Department. Several schools also make visits to the Regional Museum of Natural History and Regional Science Centre.

However, educational visits to natural areas though organized, are not mandatory in the curriculum of schools, which is framed by National and State Education Boards.

As per CBI user manual:

Average number of formal educational visits per child below 16 years to parks with natural areas or protected or secured natural areas per year

Scoring Range: (based on the CBI user manual)

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

No formal educational visits

RESULT: No Formal educational visits

SCORE: 0

Recommendations to improve score

A lot of informal educational visits to natural areas are organized in the city. In order to provide students with a practical training, nature visits should be formalised through the school curriculum. Bhopal Municipal Corporation can make this recommendation to the National and State education boards, through the State Government.

INDICATOR 15 : Budget Allocated to Biodiversity

This indicator has been calculated on the budget allocated to biodiversity as per following formula:

Scoring Range: (based on the CBI user manual)

0 point:	< 0.4%
1 point:	0.4% - 2.2%
2 points:	2.3% - 2.7%
3 points:	2.8% - 3.7%
4 points:	> 3.7%

The budget allocated by Bhopal Municipal Corporation has been taken into account for calculation. The following are the various budget allocations (in INR) for biodiversity related activities, made by Bhopal Municipal Corporation in the financial year 2021-2022.

Budget allocated by Bhopal Municipal Corporation: (2021-2022)

1. Garden management- INR 180.753 million
2. Plantation activities: INR 1350 million
3. Bhoj-Wetland Bhopal Conservation & Management Plan- INR 43.2 million

Total Budget of Bhopal Municipal Corporation: 9641.305 million

(Amount spent on biodiversity related administration) ÷ (Total budget of city) × 100

Calculations: (180.743 + 1350 + 43.2) ÷ 9641.305 × 100 = 16.325%

RESULT: 16.32 % **SCORE: 4**

Recommendations to maintain score

Although the city scores well, the budget breakup is primarily focussed on plantation and garden maintenance. In fact, the Bhoj Wetlands, which is a significant natural area gets only 2% of the total biodiversity budget. While plantation activities are important, these need to be carried out with an ecological understanding. Wetland restoration, rewilding, improving of existing habitats within the city will boost biodiversity and have long-term, far-reaching benefits. Additionally, setting aside some budget for remuneration of experienced, qualified ecologists will support Bhopal Municipal Corporation in ensuring ecologically meaningful interventions in Bhopal.

INDICATOR 16 : Number of Biodiversity Projects Implemented by the City Annually

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

Scoring Range: (based on the CBI user manual)
0 point: < 12 programmes/projects
1 point: 12 - 21 programmes/projects
2 points: 22 - 39 programmes/projects
3 points: 40 - 71 programmes/projects
4 points: > 71 programmes/projects

Bhopal Municipal Corporation and Bhopal Smart City (BSCDCL), along with other agencies undertake several biodiversity-related activities, such as plantations and afforestation programmes/drives, conservation and beautification of the lakes etc. These programmes have been listed in **Table 7** below.

Table 7: Number of Biodiversity Projects Implemented by the City Annually

S. No.	Name of project	Agency
1.	Green and Blue Master Plan for Bhopal	Bhopal Smart City Authority
2.	Bhoj-Wetland Bhopal Conservation & Management Plan	Bhopal Municipal Corporation
3.	Clean Bhopal Initiative (approx. 15 drives per year)	Bhopal Municipal Corporation
4.	Polythene Seizure program	Bhopal Municipal Corporation
5.	One Plant A Day Project	Bhopal Municipal Corporation and Bhopal Smart City
6.	Rain Water Harvesting	Bhopal Municipal Corporation
7.	Freedom to cycle	Bhopal Smart City and Decathalon
8.	Biomethenation Plant at Bittan Market	Bhopal Municipal Corporation
9.	Compost Pit Project: Home composting units	Bhopal Municipal Corporation
10.	Atal Path Project: Beautification and plantation of road	Bhopal Municipal Corporation and Bhopal Smart City
11.	Sewage Treatment Plant under Bhopal Banega Water Plus	Bhopal Municipal Corporation
12.	Project 3 R	Bhopal Municipal Corporation
13.	Bio Gas Plant	Bhopal Smart City Authority
14.	Solar City Bhopal	Bhopal Smart City Authority

As per CBI User Manual, 14 programmes categorised in score 1

RESULT: 14 **SCORE: 1**

Recommendations to maintain score

There are several non-governmental organisations, like Bhopal Birds, TNV, who are already working on biodiversity related issues. Bhopal Municipal Corporation can collaborate with these organizations and support their activities. Bringing these collaborations under their aegis can improve the score and also add value to biodiversity projects. The Bhopal Municipal Corporation can play an active role in anchoring the same.

INDICATOR 17: Policies, Rules and Regulations- Existence of LBSAP

Under the Indicator 17, LBSAP has been considered as mainstreaming document to implement NBSAP & CBD objectives.

Status of LBSAP (or any equivalent plan); number of associated CBD initiatives.

Scoring Range: (based on the CBI user manual)

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 one to three CBD initiatives
4 points:	LBSAP incorporates elements of NBSAP, and includes four or more CBD initiatives

* LBSAP or equivalent.

** The thematic programmes of work and cross-cutting issues of the CBD are listed in http://www.cbd.int/programmes/. The Strategic Plan for Biodiversity (2011-2020), including the Aichi Biodiversity Targets can also be used as a reference framework (http://www.cbd.int/sp/default.shtml).

Unfortunately, Bhopal city lacks a Local Biodiversity Strategy and Action Plan (LBSAP) or equivalent document for mainstreaming biodiversity in planning process

RESULT: No LBSAP **SCORE: 0**

Recommendations to improve score

Several scores in the CBI can be improved either directly or indirectly by developing an Local Biodiversity Strategy and Action Plan (LBSAP). It will help the city better plan and administer the local biodiversity, while making biodiversity management more transparent and scientifically informed. LBSAP or similar document will also help in mainstreaming biodiversity concerns in planning processes.

INDICATOR 18: Institutional Capacity- Essential Biodiversity Related Functions

Number of essential biodiversity related functions that the city uses. The functions may include the biodiversity centre, botanical garden, herbarium, zoological garden or museum, insectarium, etc.

Scoring Range: (based on the CBI user manual)

0 point: No functions
1 point: 1 function
2 points: 2 functions
3 points: 3 functions
4 points: > 3 functions

Bhopal city has a number of essential biodiversity related functions that are accessible to the citizens, such as:

- Indira Gandhi Rashtriya Manav Sangrahalaya detailing the natural history of human civilization and dependence on biological resources.
- Regional Science Center
- Madhya Pradesh Tribal Museum where information about the uses of biological resources by different tribal groups are displayed
- Discovery Center at Regional Museum of Natural History
- Medicinal Garden at Regional Museum of Natural History
- Butterfly interpretation center at VVNP
- Snake interpretation center at VVNP
- Medicinal garden at Government Sarojini Naidu Girls College
- Botanical Garden and Navgrah Vatika at Government Sarojini Naidu Girls College
- Herbarium at Government Sarojini Naidu Girls College
- Seed Bank at Government Sarojini Naidu Girls College
- Medicinal Garden at Lakshmi Narain College of Technology
- Medicinal Garden at Barakatullah University

RESULT: 13 **SCORE: 4**

Recommendations to maintain score

Several biodiversity functions are already present in Bhopal city, however, these are maintained autonomously, without any participation of the Urban Local Body. Bhopal Municipal Corporation can contribute to the maintenance of these institutions, exploring partnerships and ways to attract more visitors. By drawing a connect with the educational aspects, Bhopal Municipal Corporation can also facilitate connections with education boards.

INDICATOR 19: Instituional Capacity- Inter-agency Co-Operation

This indicator based on Number of city or local government agencies involved in inter-agency co-operation pertaining to biodiversity matters.

Scoring Range: (based on the CBI user manual)

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: > 5 agencies cooperate on biodiversity matters

* Agencies could include departments or authorities responsible for biodiversity, planning, water, transport, development, finance, infrastructure, etc.

The city or local government agencies that deal with biodiversity related matters are:

- Bhopal Municipal Corporation
- Bhopal Smart City Development Corporation Ltd.

RESULT: 2 **SCORE: 1**

Recommendations to improve score

The first step that Bhopal Municipal Corporation can take to improve the score under this indicator is the constitution of the Biodiversity Management Committe (BMC), it is mandatory under the Biological Diversity Act (2002) and is supported by the State Biodiversity Board can take the lead on biodiversity related matters, creating a platform for collaboration among the local government agencies.

In addition, to improve this score the city administration can look at establishing an outreach organisation of the Corporation, which will be registered separately and will function independently. This organisation will assist the city corporation in undertaking and monitoring projects and programmes related to biodiversity conservation. The city can study the example of the Centre for Heritage, Environment and Development (c-hed), established by Kochi Municipal Corporation in this regard.

INDICATOR 20: Participation and Partnership- Formal or Informal Public Consultation

This indicator based on existence and state of formal or informal public consultation process pertaining to biodiversity related matters.

Scoring Range: (based on the CBI user manual)

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

No formal or informal public consultation process on biodiversity activities is being carried out in the city.

RESULT: No Formal or Informal Public Consultation

SCORE: 0

Recommendations to improve score

The city needs to incorporate a formal public consultation process not just in biodiversity related matters, but also other sectors which have impacts on the biodiversity of the city, especially sanitation and solid waste management. This will improve public participation, public ownership and transparency. The Biodiversity Management Committee, once formed can spearhead this process of public consultation.

INDICATOR 21: Participation and Partnership- Institutional Partnership

Number of agencies/ private companies/ NGOs/ academic institutions/ international organisations with which the city is partnering in biodiversity activities, projects and programmes.

Instances of inter-agency co-operation listed in Indicator 19 should not be listed here again.

Scoring Range: (based on the CBI user manual)

0 point: No formal or informal partnerships
1 point: City in partnership with 1-6 other national or subnational agencies/private companies/NGOs/academic institutions/international organisations
2 points: City in partnership with 7-12 other national or subnational agencies/private companies/NGOs/academic institutions/international organisations
3 points: City in partnership with 13-19 other national or subnational agencies/private companies/NGOs/academic institutions/international organisations
4 points: City in partnership with 20 or more other national or subnational agencies/private companies/NGOs/academic institutions/international organisations

The Municipal Corporation partners with a number of agencies on plantation drives across the city under the project "One plant a Day" initiated by Bhopal Municipal Corporation and Bhopal Smart City Development Corporation Ltd. Under this project, The Chief Minister of the State encourages and participates in planting at least one tree every day. Bhopal Municipal Corporation partners with several agencies. The same are listed below.

1. Mannat Social Welfare Society
2. Avni Welfare Society
3. Kalakunj Foundation
4. Sakaratmak Soch
5. Shri Ram Astha Mission
6. Ehsaas Welfare Society
7. Try Foundation
8. Madhuri Ayaam Foundation
9. Lakshmi Narayan Health Welfare Society Anandam Club Bhopal
10. We Care Welfare Society
11. Hamidia College (NSS Group)
12. Shobha Devi Samajik Seva Samiti
13. Womens Power Jan Kalyan Samiti
14. Ujjawal Bhoomi Foundation:

15. Barkatullah University (NSS Group)
16. Vaishno Mahila Utsav Samiti
17. News24 Madhya Pradesh Chhattisgarh
18. Ekta Kalyan
19. Pandit Makhanlal Chaturvedi National University of Journalism and Communication (NSS Group)
20. Sanskar Sudha Foundation
21. Health Copia Foundation
22. Heartfulness Sansthan
23. Wildlife Institute of India
24. ICLEI – Local Governments for Sustainability, South Asia

RESULT: 22 **SCORE: 4**

Recommendations to maintain score

There are several other NGOs and private organizations, who are working towards improving biodiversity beyond just tree plantation. Meaningful partnerships with state and district level agencies like M.P. State Biodiversity Board, EPCO, M.P. Pollution Control Board or academic institutions that focus on biodiversity activities would have more impact on overall biodiversity governance.

INDICATOR 22: Education and Awareness- Is Biodiversity or Nature Awareness included in School Curriculum

Is biodiversity or nature awareness included in the school curriculum (e.g. biology, geography, etc.)?

Scoring Range: (based on the CBI user manual)

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

The schools within the city follow the curriculae of various boards such as the M.P. State Education Board, CBSE and ICSE. All of these boards have included biodiversity and nature awareness in various subjects like Biology, Geography, Environmental Science.

Hence, biodiversity or elements of it are included in the school curriculum bringing the score under this indicator to 4 points.

RESULT: Biodiversity or Elements of it are included in the School Curriculum

SCORE: 4

Recommendations to maintain score

It should be noted here that this indicator which measures the theoretical aspects of biodiversity education receives the highest score possible whereas indicator 14 which measures practical aspects of biodiversity education received the lowest score possible. This highlights that environmental education not just in Bhopal, but in the country at large needs to strike the right balance between theory and practice. In order to address the same, the city administration can give a directive to all schools to include visits to parks and biodiversity facilities (listed in indicator 18) in their curriculum.

INDICATOR 23: Education and Awareness- Number of Outreach or Public Awareness Events

This Indicator is about awareness programs on biodiversity organised by the city annually.

Number of outreach or public awareness events held in the city per year.

Scoring Range: (based on the CBI user manual)

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

Bhopal Municipal Corporation organizes numerous ward and city level programmes such as tree sapling distribution, World Environment Day celebration, Beej Ganesh, Narmada Marathon, Seed ball program, Swachh Bharat Mission awareness program, Clean Bhopal Initiative, and many more which falls under the **range of 1-59 outreach events in a year, hence resultant score would be 1.**

RESULT: 1-59 **SCORE: 1**

Recommendations to improve score

Several statal and parastatal authorities organize events around biodiversity throughout the year, such as in VVNP where several events involving the students and public take place; the MPSBB which organizes quizzes and awareness campaigns; and EPCO which celebrates World Wetland Day, Earth Day, and Environment Day, in collaboration with the MPSBB, and various universities. To increase the score, Bhopal Municipal Corporation can collaborate with these organizations or forge partnerships with local NGOs and Civil Society Organisations who work in related fields.

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ANNEXURE I: Methodology for Preparation of Natural Assest Map of Bhopal

1. Ward boundary of Bhopal city was collected from Smart city Bhopal Municipal Corporation in .kml format.

2. Natural Asset classes were digitised in Google Earth pro on a cloud free image of November 2021. (Mapping scale was 1:10000, 1cm on map = 100m on ground).

3. The final classes (12) are- Forest / Natural vegetation, Open scrub, Sparse vegetation, Marshes, Open Green Spaces, Lakes and ponds, River / Drainage, Riverine, Open ground, Tree patch and plantation, Agriculture, Fallow (**Table 3**).

4. The land classes are further divided in subclasses. Area wise distribution with subclasses is given in **Table 8**.

5. For convenience, the water bodies and green classes were prepared as separate .kml files and merged later.

6. The ward boundary and final NA layer were converted to shape files in ArcGIS version 10.8. The projection for both the layers was set to – geographic coordinate system (WGS 1984) and projected coordinate system (UTM, Zone 43N).

Table 8: Area Wise Distribution of subclasses

S. No.	Class Name	Subclass area (sq. km.)	Class Area (sq. km.)	Area percentage to total GA
1	Forest / Natural vegetation		21.99	5.35
1.a	Forest	16.19		
1.b	Dense Vegetation (Natural)	5.81		
2	Open scrub		9.25	2.25
2.a	Scrub on lake's bank	2.01		
2.b	Scrub Natural Vegetation	7.25		
3	Sparse vegetation		14.44	3.51
3.a	Barren	5.40		
3.b	Other vegetation	9.04		
4	Marshes	10.13	10.13	2.46
5	Open Green Spaces		6.37	1.55
5.a	Park	3.47		
5.b	Park with NV	2.89		
6	Lakes and ponds	31.23	31.23	7.60
7	River / Drainage		3.37	0.82
7.a	River (Unlined Canal)	3.16		
7.b	Lined canal	0.21		
8	Riverine	0.35	0.35	0.09
9	Open ground	4.82	4.82	1.17
10	Tree patch and plantation	21.32	21.32	5.19
11	Agriculture	147.58	147.58	35.92
12	Fallow	0.40	0.40	0.10

Visual Interpretation Key : Natural Assets were digitised in high resolution Google Earth imagery and were identified with the help of interpretation elements- shape, size, colour, texture, pattern etc. shows list of classes and corresponding interpretation keys used in classification (**Table 9**)-

Table 9: List of Land classes and corresponding interpretation keys

S. No.	Class	Size	Shape	Colour	Pattern
1	Forest / Natural vegetation	yes		yes	
2	Open scrub	yes		yes	
3	Sparse vegetation	yes		yes	
4	Marshes	yes	yes	yes	yes
5	Open Green Spaces	yes	yes	yes	
6	Lakes and ponds		yes	yes	
7	River / Drainage		yes	yes	
8	Riverine			yes	yes
9	Open ground	yes	yes		
10	Tree patch and plantation	yes	yes	yes	yes
11	Agriculture	yes	yes	yes	yes
12	Fallow			yes	

Classification Scheme

1. **Forest / Natural vegetation:** It is a is a large area dominated by trees. These areas are legally recognized and appear to be dark green and dense on google earth imagery. In addition to legally recognized forest patches there are some dense vegetated areas where city forests have been created. Area in and around VVNP and city forests are classified under this class.

1.a Forest

1.b Dense Vegetation (Natural)

2. **Open scrub:** Open scrubs are a kind of land use where grasses and shrub vegetation predominate. This type of land use is found in small patches and is natural. Some patches are also found around the lake's bank. In the Google Earth imagery it appears to be in a shade of light to dark green.

2.a Scrub on lake's bank


2.b Scrub Natural Vegetation


3. **Sparse Vegetation:** As the class is divided into two subclasses i.e., barren (sparse vegetation) and other vegetation. Other vegetation represents areas where tree cover is sparse and found mostly around the built-up area. Vegetation in vacant plots, scrub vegetation and sparse vegetation within the urban areas are classified under this class. Sparse vegetation on barren is a land where vegetation is present on the rocky surfaces. They appear to be irregular in shape and are green to yellow in colour (in imagery).

3a. Barren


3b. Other vegetation


4. **Marshes:** These are wetland ecosystems dominated by herbaceous plants, such as grasses, reeds, and sedges. Marshes are mostly located near lakes and larger water bodies. They appear to be bright green in google imagery.


5. **Open Green Spaces:** These are areas with trees and plantation meant for recreational purposes. They have a defined boundary and are accessible to public, therefore parks are present around built-up areas. Some of the parks have very dense vegetation hence the land class is divided into parks and parks with natural vegetation. All the parks have been digitised and classified under this class.

5.a Parks


5.b Parks with Natural Vegetation


6. **Lakes and ponds:** These areas are lentic ecosystems, water bodies which appears to be dark blue and sometime greenish in colour. The city is characterised by presence by 2 important lakes, upper lake and lower lake and several small ponds.


7. **River / Drainage:** Streams connecting water bodies across Bhopal city. They appear to be of irregular shaped streams. This class is bifurcated into subclass, lined and unlined drainage/ canals as given in **Table 8**. The lined canals are concreated regular shaped streams.

7.a River (Unlined Canal)


7.b Lined canal


8. **Riverine:** The vegetation present on the banks of canals of river is classified under this land class. They appear in irregular pattern and green in colour.


9. **Open ground:** These are the areas meant for the sports activities and appear brown in colour. These are mostly found around the school or college campuses.


10. **Tree patch and plantation:** These are patches of trees that appear to be regular in shape (linear or rectangle patches) and are dark green in the imagery. Tree plantations around roadside, railway tracks, etc are classified under this class.


11. **Agricultural:** It is land area which is being used for crop production. The land use class is characterised by regular checkerboard shaped areas with defined boundaries. They appear to be in different shades of green-yellow colour.


12. **Fallow land:** These area are agricultural lands which have no growing crops, they appear to be brown or yellow in colour and are adjacent to agricultural fields.


ANNEXURE II- Calculation of Connectivity Areas

Table 10: Number and area of patches used in the calculation of Indicator 2

Patch_ name	Patch Area_A	Patch Area_A * Patch Area_A
A01	6133.27	37617000.90
A02	416.15	173178.33
A03	401.97	161575.86
A04	161.80	26179.89
A05	121.01	14643.66
A06	99.98	9995.32
A07	75.83	5750.20
A08	41.20	1697.37
A09	38.74	1500.69
A10	31.74	1007.28
A11	30.76	946.26
A12	28.48	810.85
A13	22.42	502.48
A14	20.88	436.00
A15	19.47	379.22
A16	19.11	365.30
A17	15.40	237.07
A18	14.30	204.56
A19	12.72	161.72
A20	12.59	158.62
A21	12.57	158.11
A22	12.33	152.13
A23	11.10	123.31
A24	10.09	101.77
A25	8.19	67.06
A26	8.16	66.61
A27	7.41	54.90
A28	7.03	49.36
A29	6.80	46.30
A30	6.70	44.84
A31	5.96	35.56
A32	5.94	35.25
A33	4.50	20.22
A34	3.89	15.13
A35	3.56	12.65
A36	3.28	10.78
A37	3.05	9.32
A38	2.62	6.89
A39	2.48	6.13
A40	2.39	5.72
A41	2.38	5.66
A42	2.27	5.14
A43	2.20	4.85
A44	2.02	4.10
A45	1.95	3.81

Patch_ name	Patch Area_A	Patch Area_A * Patch Area_A
A46	1.92	3.67
A47	1.72	2.96
A48	1.57	2.46
A49	1.54	2.37
A50	1.50	2.26
A51	1.47	2.17
A52	1.38	1.90
A53	1.32	1.74
A54	1.32	1.74
A55	1.26	1.58
A56	1.23	1.50
A57	1.21	1.46
A58	1.19	1.41
A59	1.14	1.30
A60	1.07	1.14
A61	0.98	0.97
A62	0.98	0.97
A63	0.97	0.94
A64	0.89	0.78
A65	0.87	0.76
A66	0.83	0.69
A67	0.80	0.63
A68	0.74	0.54
A69	0.73	0.53
A70	0.63	0.39
A71	0.53	0.28
A72	0.51	0.26
A73	0.50	0.25
A74	0.49	0.24
A75	0.45	0.20
A76	0.34	0.11
A77	0.33	0.11
A78	0.33	0.11
A79	0.31	0.10
A80	0.30	0.09
A81	0.26	0.07
A82	0.25	0.06
A83	0.23	0.05
A84	0.20	0.04
A85	0.20	0.04
A86	0.19	0.04
A87	0.18	0.03
A88	0.18	0.03
A89	0.15	0.02

ANNEXURE III- List of Flora and Fauna Species in Bhopal City

Table 11: List of Bird species in Bhopal city

S. No.	Family Name	Species Common Name	Scientific Name	Status	Built-up Species
1	Accipitridae	Shikra	*Accipiter badius*	R	Yes
2	Accipitridae	Greater Spotted Eagle	*Aquila clanga*	V	No
3	Accipitridae	Indian Spotted Eagle	*Aquila hastata*	V	No
4	Accipitridae	Imperial Eagle	*Aquila heliaca*	V	No
5	Accipitridae	Steppe Eagle	*Aquila nipalensis*	WM	No
6	Accipitridae	White Eye Buzzard	*Butastur teesa*	R	No
7	Accipitridae	Long-legged Buzzard	*Buteo rufinus*	V	No
8	Accipitridae	Marsh Harrier	*Circus aeruginosus*	WM	No
9	Accipitridae	Black Shouldered Kite	*Elanus caeruleus*	R	Yes
10	Accipitridae	White rumped Vulture	*Gyps bengalensis*	R	No
11	Accipitridae	Brahminy Kite	*Haliastur indus*	LM	No
12	Accipitridae	Booted Eagle	*Hieraaetus pennatus*	V	No
13	Accipitridae	Black Eagle	*Ictinaetus malayensis*	R	No
14	Accipitridae	Black Kite	*Milvus migrans*	R	Yes
15	Accipitridae	Egyptian Vulture	*Neophorn percnopterus*	R	Yes
16	Accipitridae	Oriental Honey Buzzard	*Pernis ptilorhyncus*	R	No
17	Accipitridae	Red Headed Vulture	*Sarcogyps calvus*	R	No
18	Accipitridae	Crested-serpent Eagle	*Spilornis cheela*	R	No
19	Aegithalidae	Common Iora	*Aegithina tiphia*	R	Yes
20	Aegithalidae	Marshall's Iora	*Aegithina nigrolutea*	LM	No
21	Alaudidae	Ashy crowned sparrow lark	*Eremopterix griseus*	R	Yes
22	Alaudidae	Crested Lark	*Galerida cristata*	R	Yes
23	Alaudidae	Indian Bushlark	*Mirafra erythroptera*	LM	No
24	Alaudidae	Rufous tailed lark	*Ammomanes phoenicurus*	R	No
25	Alaudidae	Singing Bushlark	*Mirafra cantillans*	LM	No
26	Alcedinidae	Common Kingfisher	*Alcedo atthis*	R	Yes
27	Alcedinidae	Stork billed Kingfisher	*Halcyon capensis*	R	No
28	Alcedinidae	White throated kingfisher	*Halcyon smyrnensis*	R	Yes
29	Anatidae	Northern Pintail	*Anas acuta*	WM	No
30	Anatidae	Common Teal	*Anas crecca*	WM	No
31	Anatidae	Eurasian Wigeon	*Anas penelope*	WM	No
32	Anatidae	Mallard	*Anas platyrhynchos*	WM	No
33	Anatidae	Spot-billed Duck	*Anas poecilorhyncha*	LM	No
34	Anatidae	Gargeny	*Anas querquedula*	WM	No
35	Anatidae	Gadwall	*Anas strepera*	WM	No
36	Anatidae	Greylag goose	*Anser anser*	WM	No
37	Anatidae	Bar Headed Goose	*Anser indicus*	V	No
38	Anatidae	Common Pochard	*Aythya ferina*	WM	No
39	Anatidae	Ferruginous Pochard	*Aythya nyroca*	WM	No
40	Anatidae	Lesser whistling Teal	*Dendrocygna javanica*	LM	No
41	Anatidae	Cotton Pygmy Goose	*Nettapus coromandelianus*	LM	No
42	Anatidae	Red Crested Pochard	*Rhodonessa rufina*	WM	No
43	Anatidae	Comb Duck	*Sarkidiornis melanotos*	WM	No
44	Anatidae	Northern Shoveller	*Spatula clypeata*	WM	No
45	Anatidae	Ruddy Shelduck	*Tadorna ferruginea*	WM	No

S. No.	Family Name	Species Common Name	Scientific Name	Status	Built-up Species
46	Anhingidae	Oriental Darter	*Anhinga melanogaster*	WM	No
47	Apodidae	Alpine Swift	*Tachymarptis melba*	LM	No
48	Apodidae	Asian Palm Swift	*Cypsiurus balasiensis*	M	No
49	Apodidae	Little Swift	*Apus affinis*	R	No
50	Ardeidae	Black Bittern	*Dupetor flavicollis*	LM	No
51	Ardeidae	Black crowned Night Heron	*Nycticorax nycticorax*	R	No
52	Ardeidae	Cattle Egret	*Bubulcus ibis*	R	Yes
53	Ardeidae	Cinnamon Bittern	*Ixobrychus cinnamomeus*	SW	No
54	Ardeidae	Great Egret	*Ardea alba*	R	Yes
55	Ardeidae	Grey Heron	*Ardea cinerea*	LM	Yes
56	Ardeidae	Indian Pond Heron	*Ardeola grayii*	R	Yes
57	Ardeidae	Intermediate Egret	*Ardea intermedia*	R	Yes
58	Ardeidae	Little Egret	*Egretta garzetta*	R	Yes
59	Ardeidae	Purple Heron	*Ardea purpurea*	LM	Yes
60	Ardeidae	Striated Heron	*Butorides striata*	R	No
61	Bucerotidae	Indian Grey Hornbill	*Ocyceros birostris*	R	Yes
62	Burhinidae	Great Thick-knee	*Esacus recurvirostris*	R	No
63	Campephagidae	Black-headed Cuckooshrike	*Coracina melanoptera*	LM	No
64	Campephagidae	Large Cuckoo Shrike	*Coracina macei*	R	No
65	Campephagidae	Long-tailed Minivet	*Pericrocotus ethologus*	WM	No
66	Campephagidae	Scarlet Minivet	*Pericrocotus flammeus*	R	No
67	Campephagidae	Small Minivet	*Pericrocotus cinnamomeus*	R	No
68	Campephagidae	White-bellied Minivet	*Pericrocotus erythropygius*	LM	No
69	Caprimulgidae	Indian Nightjar	*Caprimulgus asiaticus*	R	No
70	Caprimulgidae	Large-tailed Nightjar	*Caprimulgus macrurus*	LM	No
71	Caprimulgidae	Savanna Nigtjar	*Caprimulgus affinis*	R	No
72	Centropidae	Greater Coucal	*Centropus sinensis*	R	Yes
73	Cerylidae	Pied Kingfisher	*Ceryle rudis*	R	Yes
74	Charadriidae	Grey-headed Lapwing	*Vanellus cinereus*	WM	No
75	Charadriidae	Little-ringed Plover	*Charadrius dubius*	WM	Yes
76	Charadriidae	Red Wattled Lapwing	*Vanellus indicus*	R	Yes
77	Charadriidae	River Lapwing	*Vanellus duvaucelii*	V	No
78	Charadriidae	Yellow-wattled Lapwing	*Vanellus malabaricus*	R	No
79	Ciconiidae	Asian Openbill	*Anastomus oscitans*	R	Yes
80	Ciconiidae	Black-necked Stork	*Ephippiorhynchus asiaticus*	M	No
81	Ciconiidae	Lesser Adjutant	*Leptoptilos javanicus*	V	No
82	Ciconiidae	Painted Stork	*Mycteria leucocephala*	LM	No
83	Ciconiidae	White Stork	*Ciconia ciconia*	PM	No
84	Ciconiidae	Woolly-necked Stork	*Ciconia episcopus*	LM	Yes
85	Cisticolidae	Ashy Prinia	*Prinia socialis*	R	Yes
86	Cisticolidae	Common Tailorbird	*Orthotomus sutorius*	R	Yes
87	Cisticolidae	Grey-breasted Prinia	*Prinia hodgsonii*	R	No
88	Cisticolidae	Jungle Prinia	*Prinia sylvatica*	LM	No
89	Cisticolidae	Plain Prinia	*Prinia inornata*	R	Yes
90	Cisticolidae	Zitting Cisticola	*Cisticola juncidis*	R	No
91	Columbidae	Blue-rock Pigeon	*Columba livia*	R	Yes
92	Columbidae	Eurasian Collared Dove	*Streptopelia decaocto*	R	Yes
93	Columbidae	Laughing Dove	*Spilopelia senegalensis*	R	Yes
94	Columbidae	Orange–breasted Green Pigeon	*Treron bicinctus*	V	No
95	Columbidae	Oriental Turtle Dove	*Streptopelia orientalis*	R	Yes
96	Columbidae	Red-collared Dove	*Streptopelia tranquebarica*	R	No

S. No.	Family Name	Species Common Name	Scientific Name	Status	Built-up Species
97	Columbidae	Spotted Dove	*Spilopelia chinensis*	R	Yes
98	Columbidae	Yellow-footed Green Pigeon	*Treron phoenicopterus*	R	No
99	Coraciidae	European Roller	*Coracias garrulus*	V	No
100	Coraciidae	Indian Roller	*Coracias benghalensis*	R	Yes
101	Corvidae	Black-hooded Oriole	*Oriolus xanthornus*	R	Yes
102	Corvidae	House Crow	*Corvus splendens*	R	Yes
103	Corvidae	Indian Golden Oriole	*Oriolus kundoo*	SM	Yes
104	Corvidae	Jungle Crow	*Corvus culminatus*	R	No
105	Corvidae	Larged-billed Crow	*Corvus macrorhynchos*	R	No
106	Corvidae	Rufous Treepie	*Dendrocitta vagabunda*	R	Yes
107	Cuculidae	Asian Koel	*Eudynamys scolopacea*	LM	Yes
108	Cuculidae	Common-hawk Cuckoo	*Hierococcyx varius*	R	Yes
109	Cuculidae	Common Cuckoo	*Cuculus canorus*	SM	Yes
110	Cuculidae	Grey-bellied Cuckoo	*Cacomantis passerinus*	SM	No
111	Cuculidae	Indian Cuckoo	*Cuculus micropterus*	SM	Yes
112	Cuculidae	Jacobin Cuckoo	*Clamator jacobinus*	SM	Yes
113	Cuculidae	Plaintive Cuckoo	*Cacomantis merulinus*	V	No
114	Cuculidae	Sirkeer malkoha	*Phaenicophaeus leschenaultii*	R	No
115	Dicaeidae	Thick-billed Flowerpecker	*Dicaeum agile*	R	No
116	Dicruridae	Black Drongo	*Dicrurus macrocercus*	R	Yes
117	Dicruridae	White-bellied Drongo	*Dicrurus caerulescens*	R	Yes
118	Estrildidae	Black–headed Munia	*Lonchura malacca*	LM	No
119	Estrildidae	Indian Silverbill	*Euodice malabarica*	R	Yes
120	Estrildidae	Red Avadavat	*Amandava amandava*	R	Yes
121	Estrildidae	Scaly-breasted Munia	*Lonchura punctulata*	R	Yes
122	Estrildidae	White-rumped Munia	*Lonchura striata*	LM	No
123	Falconidae	Common Kestrel	*Falco tinnunculus*	WM	No
124	Falconidae	Eurasian Hobby	*Falco subbuteo*	WM	No
125	Falconidae	Peregrine Falcon	*Falco peregrinus*	WM	No
126	Fringillidae	Black-headed Bunting	*Emberiza melanocephala*	WM	No
127	Fringillidae	Crested Bunting	*Melophus lathami*	R	No
128	Fringillidae	Grey necked Bunting	*Emberiza buchanani*	WM	No
129	Fringillidae	Red Headed Bunting	*Emberiza bruniceps*	WM	Yes
130	Glareolidae	Small Pratincole	*Glareola lactea*	R	No
131	Gruidae	Sarus Crane	*Antigone antigone*	R	No
132	Hemiprocnidae	Crested Treeswift	*Hemiprocne coronata*	R	No
133	Hirundinidae	Barn Swallow	*Hirundo rustica*	WM	Yes
134	Hirundinidae	Dusky Crag Martin	*Hirundo concolor*	R	No
135	Hirundinidae	Red-rumped Swallow	*Cecropis daurica*	R	Yes
136	Hirundinidae	Wire-tailed Swallow	*Hirundo smithii*	R	Yes
137	Irenidae	Golden-fronted Leafbird	*Chloropsis aurifrons*	R	No
138	Irenidae	Jerdon's Leafbird	*Chloropsis Jerdoni*	R	No
139	Jacanidae	Bronze-winged Jacana	*Metopidius indicus*	R	No
140	Jacanidae	Pheasant-tailed Jacana	*Hidrophasianus chirurgus*	R	No
141	Laniidae	Bay-backed Shrike	*Lanius vittatus*	R	Yes
142	Laniidae	Brown Shrike	*Lanius cristatus*	WM	No
143	Laniidae	Isabelline Shrike	*Lanius isabellinus*	WM	No
144	Laniidae	Long-tailed Shrike	*Lanius schach*	R	Yes
145	Laniidae	Southern Grey Shrike	*Lanius meridionalis*	LM	No
146	Laridae	Black-bellied Tern	*Sterna acuticauda*	WM	No
147	Laridae	Black-headed Gull	*Larus ridibundus*	WM/V	No

S. No.	Family Name	Species Common Name	Scientific Name	Status	Built-up Species
148	Laridae	Brown-headed Gull	*Chroicocephalus brunnicephalus*	WM/V	No
149	Laridae	Caspian Gull	*Larus cachinnans*	WM	No
150	Laridae	Little Tern	*Sterna albifrons*	LM	No
151	Laridae	Pallas's Gull	*Larus ichthyaetus*	WM	No
152	Laridae	River Tern	*Sterna aurantia*	R	Yes
153	Laridae	Whiskered Tern	*Chlidonias hybridus*	R	No
154	Leiothrichidae	Common Babbler	*Turdoides caudatus*	R	Yes
155	Leiothrichidae	Jungle Babbler	*Turdoides striata*	R	Yes
156	Leiothrichidae	Large grey Babbler	*Turdoides malcolmi*	R	No
157	Locustellidae	Bristled Grass Bird	*Chaetornis striata*	LM	No
158	Megalaimidae	Brown-headed Barbet	*Megalaima zeylanica*	R	No
159	Megalaimidae	Coppersmith Barbet	*Megalaima haemacephala*	R	Yes
160	Meropidae	Blue-tailed bee-eater	*Merops philippinus*	R	Yes
161	Meropidae	Green Bee-eater	*Merops orientalis*	R	Yes
162	Monarchidae	Asian Paradise Flycatcher	*Terpsiphone paradisi*	LM	Yes
163	Monarchidae	Black naped Monarch	*Hypothymis azurea*	R	Yes
164	Motacillidae	Blyth's Pipit	*Anthus godlewskii*	WM	No
165	Motacillidae	Tree Pipit	*Anthus trivialis*	WM	Yes
166	Motacillidae	Citrine Wagtail	*Motacilla citreola*	WM	No
167	Motacillidae	Grey Wagtail	*Motacilla cinerea*	WM	Yes
168	Motacillidae	Paddyfield Pipit	*Anthus rufulus*	R	Yes
169	Motacillidae	White-browed Wagtail	*Motacilla maderaspatensis*	R	Yes
170	Motacillidae	White Wagtail	*Motacilla alba*	WM	Yes
171	Motacillidae	Yellow Wagtail	*Motacilla flava*	WM	Yes
172	Muscicapidae	Asian Brown Flycatcher	*Muscicapa dauurica*	LM	No
173	Muscicapidae	Black Redstart	*Phoenicurus ochruros*	WM	Yes
174	Muscicapidae	Brown Rock chat	*Cercomela fusca*	R	Yes
175	Muscicapidae	Common Stonechat	*Saxicola leucura*	WM	No
176	Muscicapidae	Indian Robin	*Saxicoloides fulicata*	R	Yes
177	Muscicapidae	Magpie Robin	*Copsychus saularis*	R	Yes
178	Muscicapidae	Pied Bushchat	*Saxicola caprata*	R	Yes
179	Muscicapidae	Red-breasted Flycatcher	*Ficedula parva*	WM	Yes
180	Muscicapidae	Taiga Flycatcher	*Ficedula albicilla*	WM	No
181	Muscicapidae	Tickell's Blue Flycatcher	*Cyornis tickelliae*	R	No
182	Muscicapidae	Ultramarine Flycatcher	*Ficedula superciliaris*	WM	No
183	Muscicapidae	Verditer Flycatcher	*Eumyias thalassina*	WM	No
184	Nectariniidae	Purple-rumped Sunbird	*Leptocoma zeylonica*	LM	Yes
185	Nectariniidae	Purple Sunbird	*Cinnyris asiaticus*	R	Yes
186	Pandionidae	Osprey	*Pandion haliaetus*	WM	Yes
187	Paridae	Cinereous Tit	*Parus cinereus*	R	Yes
188	Paridae	Great Tit	*Parus major*	R	No
189	Passeridae	Chestnut-shouldered Patronia	*Petronia xanthocollis*	R	No
190	Passeridae	House Sparrow	*Passer domesticus*	R	Yes
191	Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	R	Yes
192	Phalacrocoracidae	Little Cormorant	*Microcarbo niger*	LM	Yes
193	Phasianidae	Black Francolin	*Francolinus francolinus*	R	No
194	Phasianidae	Common Quail	*Coturnix coturnix*	WM	Yes
195	Phasianidae	Grey Francolin	*Francolinus pondicerianus*	R	Yes
196	Phasianidae	Indian Peafowl	*Pavo cristatus*	R	Yes
197	Phasianidae	Painted Francolin	*Francolinus pictus*	R	Yes

S. No.	Family Name	Species Common Name	Scientific Name	Status	Built-up Species
198	Phylloscopidae	Common Chiffchaff	*Phylloscopus collybita*	WM	No
199	Phylloscopidae	Greenish Warbler	*Phylloscopus trochiloides*	WM	No
200	Phylloscopidae	Hume's Warbler	*Phylloscopus humei*	WM	Yes
201	Phylloscopidae	Tickell's Leaf Warbler	*Phylloscopus affinis*	WM	No
202	Picidae	Black-rumped Flameback	*Dinopium benghalense*	R	Yes
203	Picidae	Brown-capped Pygmy Woodpecker	*Dendrocopos nanus*	R	No
204	Picidae	Eurasian Wryneck	*Jynx torquilla*	M	No
205	Picidae	White naped Woodpecker	*Chrysocolaptes festivus*	R	No
206	Picidae	Yellow crowned Woodpecker	*Dendrocopos mahrattensis*	R	No
207	Pittidae	Indian Pitta	*Pitta brachyura*	SM	No
208	Ploceidae	Baya Weaver	*Ploceus philippinus*	R	No
209	Podicipedidae	Little Grebe (Dabchick)	*Tachybaptus ruficollis*	LM	Yes
210	Prionopidae	Common Woodshrike	*Tephrodornis pondicerianus*	R	No
211	Psittacidae	Alexandrine parakeet	*Psittacula eupatria*	R	Yes
212	Psittacidae	Plum-headed Parakeet	*Psittacula cyanocephala*	R	Yes
213	Psittacidae	Rose-ring parakeet	*Psittacula krameri*	R	Yes
214	Pycnonotidae	Red-vented Bulbul	*Pycnonotus cafer*	R	Yes
215	Rallidae	Baillon's Crake	*Prozana pusilla*	WM	No
216	Rallidae	Brown Crake	*Amaurornis akool*	LM	No
217	Rallidae	Common Moorhen	*Gallinula chloropus*	R	Yes
218	Rallidae	Eurasian Coot	*Fulica atra*	R	No
219	Rallidae	Purple Moorhen	*Porphyrio porphyrio*	R	Yes
220	Rallidae	Slaty-breasted Rail	*Gallirallus striatus*	LM	No
221	Rallidae	Watercock	*Gallicrex cinerea*	R	No
222	Rallidae	White-breasted Waterhen	*Amaurornis phoenicurus*	R	Yes
223	Recurvirostridae	Black-winged Stilt	*Himantopus himantopus*	R	Yes
224	Recurvirostridae	Pied Avocet	*Recurvirostra avosetta*	WM	No
225	Rhipiduridae	White-browed Fantail	*Rhipidura aureola*	R	Yes
226	Rostratulidae	Painted Snipe	*Rostratula benghalensis*	WM	No
227	Scolopacidae	Bar-tailed Godwit	*Limosa lapponica*	WM	No
228	Scolopacidae	Black-tailed Godwit	*Limosa limosa*	WM	No
229	Scolopacidae	Common Greenshank	*Tringa nebularia*	WM	No
230	Scolopacidae	Common Redshank	*Tringa totanus*	WM	No
231	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	WM	No
232	Scolopacidae	Common Snipe	*Gallinago gallinago*	WM	No
233	Scolopacidae	Eurasian Curlew	*Numenius arquata*	WM	No
234	Scolopacidae	Green Sandpiper	*Tringa ochropus*	WM	Yes
235	Scolopacidae	Little Stint	*Calidris minuta*	WM	No
236	Scolopacidae	Marsh sandpiper	*Tringa stagnatilis*	WM	No
237	Scolopacidae	Spotted Redshank	*Tringa erythropus*	WM	No
238	Scolopacidae	Temminck's Stint	*Calidris temminckii*	WM	No
239	Scolopacidae	Wood Sandpiper	*Tringa glareola*	WM	Yes
240	Sittidae	Indian Nuthatch	*Sitta Castanea*	LM	No
241	Stenostiridae	Grey-headed Canary Flycatcher	*Culicicapa ceylonensis*	WM	No
242	Strigidae	Brown Fish-owl	*Ketupa zelonensis*	LM	No
243	Strigidae	Dusky Eagle Owl	*Bubo coromandus*	LM	No
244	Strigidae	Eurasian Eagle Owl	*Bubo bubo*	LM	No
245	Strigidae	Indian Scops Owl	*Otus bakkamoena*	R	No
246	Strigidae	Jungle Owlet	*Glaucidium radiatum*	R	No

S. No.	Family Name	Species Common Name	Scientific Name	Status	Built-up Species
247	Strigidae	Mottled Wood Owl	*Strix ocellata*	R	No
248	Strigidae	Spotted Owlet	*Athene brama*	R	Yes
249	Sturnidae	Asian Pied Starling	*Sturnus contra*	R	Yes
250	Sturnidae	Brahminy Starling	*Sturnus pagodarum*	R	Yes
251	Sturnidae	Chestnut Tailed Starling	*Sturnia malabarica*	WM	No
252	Sturnidae	Common Myna	*Acridotheres tristis*	R	Yes
253	Sturnidae	Rosy Starling	*Sturnus roseus*	WM	Yes
254	Sylviidae	Blyth's Reed Warbler	*Acrocephalus dumetorum*	WM	No
255	Sylviidae	Booted Warbler	*Hippolais caligata*	WM	No
256	Sylviidae	Clamorous Reed Warbler	*Acrocephalus stentoreus*	WM	No
257	Sylviidae	Lesser Whitethroat	*Sylvia curruca*	WM	Yes
258	Threskiornithidae	Black-headed Ibis	*Threskiornis melanocephalus*	LM	Yes
259	Threskiornithidae	Red Naped Ibis	*Pseudibis papillosa*	LM	No
260	Threskiornithidae	Eurasian Spoonbill	*Platalea leucorodia*	M	No
261	Threskiornithidae	Glossy Ibis	*Plegadis falcinellus*	LM	Yes
262	Timaliidae	Tawny-bellied Babbler	*Dumetia hyperythra*	R	No
263	Timaliidae	Yellow-eyed Babbler	*Chrysomma sinense*	R	Yes
264	Turdidae	Blue Rock Thrush	*Monticola solitarius*	WM	No
265	Turdidae	Bluethroat	*Luscinia svecica*	WM	No
266	Turdidae	Indian Blackbird	*Turdus merula*	R	No
267	Turdidae	Orange-headed Thrush	*Zoothera citrina*	LM	No
268	Turnicidae	Barred Button Quail	*Turnix suscitator*	R	No
269	Turnicidae	Yellow-legged Buttonquail	*Turnix tanki*	R	No
270	Turnicidae	Small Buttonquail	*Turnix sylvaticus*	R	No
271	Tytonidae	Barn Owl	*Tyto alba*	R	No
272	Tytonidae	Brown Wood Owl	*Strix leptogrammica*	V	No
273	Upupidae	Common Hoopoe	*Upupa epops*	R	Yes
274	Zosteropidae	Oriental White eye	*Zosterops palpebrosus*	R	Yes

Note: Status-(Resident R, Local Migratory LM, Winter Migratory WM, Summer Migratory SM, Passage Migrant PM, Vagrant V)

Table 12: List of Plant species in Bhopal city

S. No.	Family Name	Scientific Name	Habit
1	Anacardiaceae	*Anacardium occidentale*	Tree
2	Anacardiaceae	*Buchanania cochinchinensis*	Tree
3	Anacardiaceae	*Buchanania latifolia*	Tree
4	Anacardiaceae	*Lannea coromandelica*	Tree
5	Anacardiaceae	*Lannea grandis*	Tree
6	Anacardiaceae	*Mangifera indica*	Tree
7	Anacardiaceae	*Semecarpus anacardium*	Tree
8	Anacardiaceae	*Spondias mangifera*	Tree
9	Annonaceae	*Annona reticulata*	Tree
10	Annonaceae	*Annona squamosa*	Tree
11	Annonaceae	*Cananga odorata*	Tree
12	Annonaceae	*Polyalthia longifolia*	Tree
13	Annonaceae	*Saccopetalum tomentosum*	Tree
14	Annonaceae	*Uvaria tomentosa*	Tree
15	Apocynaceae	*Alstonia scholaris*	Tree
16	Apocynaceae	*Calotropis gigantea*	Tree
17	Apocynaceae	*Carissa carandas*	Tree
18	Apocynaceae	*Nerium indicum*	Tree
19	Apocynaceae	*Plumeria alba*	Tree
20	Apocynaceae	*Plumeria obtusa*	Tree
21	Apocynaceae	*Plumeria rubra*	Tree
22	Apocynaceae	*Tabernaemontana divaricata*	Tree
23	Apocynaceae	*Thevetia neriifolia*	Tree
24	Apocynaceae	*Wrightia antidysenterica*	Tree
25	Apocynaceae	*Wrightia arborea*	Tree
26	Apocynaceae	*Wrightia tinctoria*	Tree
27	Arecaceae	*Caryota urens*	Tree
28	Arecaceae	*Cocos nucifera*	Tree
29	Arecaceae	*Hyophorbe lagenicaulis*	Tree
30	Arecaceae	*Livistona chinensis*	Tree
31	Arecaceae	*Oreodoxia regia*	Tree
32	Arecaceae	*Phoenix sylvestris*	Tree
33	Arecaceae	*Roystonea regia*	Tree
34	Asparagaceae	*Beaucarnea recurvata*	Tree
35	Asparagaceae	*Dracaena fragrans*	Tree
36	Bignoniaceae	*Crescentia cujete*	Tree
37	Bignoniaceae	*Dolichandrone falcata*	Tree
38	Bignoniaceae	*Fernandoa adenophylla*	Tree
39	Bignoniaceae	*Jacaranda mimosifolia*	Tree
40	Bignoniaceae	*Kigelia africana*	Tree
41	Bignoniaceae	*Markhamia lutea*	Tree
42	Bignoniaceae	*Millingtonia hortensis*	Tree
43	Bignoniaceae	*Oroxylum indicum*	Tree
44	Bignoniaceae	*Spathodea campanulata*	Tree
45	Bignoniaceae	*Stereospermum suaveolens*	Tree
46	Bignoniaceae	*Stereospermum tetragonum*	Tree
47	Bignoniaceae	*Tabebuia alba*	Tree

S. No.	Family Name	Scientific Name	Habit
48	Bignoniaceae	*Tabebuia aurea*	Tree
49	Bignoniaceae	*Tabebuia heterophylla*	Tree
50	Bignoniaceae	*Tecoma stans*	Tree
51	Bixaceae	*Bixa orellana*	Tree
52	Bixaceae	*Cochlospermum religiosum*	Tree
53	Bombacaceae	*Salmalia malabarica*	Tree
54	Boraginaceae	*Cordia mecleodii*	Tree
55	Boraginaceae	*Ehretia laevis*	Tree
56	Burseraceae	*Boswellia serrata*	Tree
57	Burseraceae	*Garuga pinnata*	Tree
58	Capparaceae	*Crataeva adansonii*	Tree
59	Caricaceae	*Carica papaya*	Tree
60	Casuarinaceae	*Casuarina equisetifolia*	Tree
61	Celastraceae	*Cassine glauca*	Tree
62	Celastraceae	*Elaeodendron glaucum*	Tree
63	Celastraceae	*Gymnosporia senegalensis*	Tree
64	Combretaceae	*Anogeissus acuminata*	Tree
65	Combretaceae	*Anogeissus latifolia*	Tree
66	Combretaceae	*Anogeissus pendula*	Tree
67	Combretaceae	*Terminalia arjuna*	Tree
68	Combretaceae	*Terminalia bellirica*	Tree
69	Combretaceae	*Terminalia catappa*	Tree
70	Combretaceae	*Terminalia chebula*	Tree
71	Combretaceae	*Terminalia tomentosa*	Tree
72	Cordiaceae	*Cordia dichotoma*	Tree
73	Cordiaceae	*Cordia gharaf*	Tree
74	Cordiaceae	*Cordia sebestena*	Tree
75	Cornaceae	*Alangium salvifolium*	Tree
76	Dilleniaceae	*Dillenia indica*	Tree
77	Dipterocarpaceae	*Shorea robusta*	Tree
78	Ebenaceae	*Diospyros melanoxylon*	Tree
79	Ehretiaceae	*Ehretia acuminata*	Tree
80	Euphorbiaceae	*Euphorbia leucocephala*	Tree
81	Euphorbiaceae	*Euphorbia neriifolia*	Tree
82	Euphorbiaceae	*Euphorbia tirucalli*	Tree
83	Euphorbiaceae	*Jatropha curcas*	Tree
84	Euphorbiaceae	*Mallotus philippensis*	Tree
85	Euphorbiaceae	*Ricinus communis*	Tree
86	Fabaceae	*Acacia auriculiformis*	Tree
87	Fabaceae	*Acacia catechu*	Tree
88	Fabaceae	*Acacia concinna*	Tree
89	Fabaceae	*Acacia ferruginea*	Tree
90	Fabaceae	*Acacia leucophloea*	Tree
91	Fabaceae	*Acacia nilotica*	Tree
92	Fabaceae	*Acacia polycantha*	Tree
93	Fabaceae	*Acacia tortilis*	Tree
94	Fabaceae	*Albizia amara*	Tree
95	Fabaceae	*Albizia lebbeck*	Tree
96	Fabaceae	*Albizia odoratissima*	Tree
97	Fabaceae	*Albizia procera*	Tree
98	Fabaceae	*Albizia saman*	Tree
99	Fabaceae	*Bauhinia malabarica*	Tree
100	Fabaceae	*Bauhinia purpurea*	Tree

S. No.	Family Name	Scientific Name	Habit
101	Fabaceae	*Bauhinia racemosa*	Tree
102	Fabaceae	*Bauhinia retusa*	Tree
103	Fabaceae	*Bauhinia semibifida*	Tree
104	Fabaceae	*Bauhinia variegata*	Tree
105	Fabaceae	*Brya ebenus*	Tree
106	Fabaceae	*Butea monosperma*	Tree
107	Fabaceae	*Calliandra haematocephala*	Tree
108	Fabaceae	*Cassia fistula*	Tree
109	Fabaceae	*Cassia grandis*	Tree
110	Fabaceae	*Cassia javanica*	Tree
111	Fabaceae	*Cassia nodosa*	Tree
112	Fabaceae	*Cassia renigera*	Tree
113	Fabaceae	*Cassia roxburghii*	Tree
114	Fabaceae	*Dalbergia lanceolaria*	Tree
115	Fabaceae	*Dalbergia latifolia*	Tree
116	Fabaceae	*Dalbergia paniculata*	Tree
117	Fabaceae	*Dalbergia sissoo*	Tree
118	Fabaceae	*Delonix regia*	Tree
119	Fabaceae	*Desmodium oojeinense*	Tree
120	Fabaceae	*Erythrina stricta*	Tree
121	Fabaceae	*Erythrina suberosa*	Tree
122	Fabaceae	*Erythrina variegata*	Tree
123	Fabaceae	*Gliricidia maculata*	Tree
124	Fabaceae	*Leucaena leucocephala*	Tree
125	Fabaceae	*Millettia peguensis*	Tree
126	Fabaceae	*Parkia biglandulosa*	Tree
127	Fabaceae	*Parkia timoriana*	Tree
128	Fabaceae	*Parkinsonia aculeata*	Tree
129	Fabaceae	*Peltophorum africanum*	Tree
130	Fabaceae	*Peltophorum pterocarpum*	Tree
131	Fabaceae	*Pithecellobium dulce*	Tree
132	Fabaceae	*Pongamia pinnata*	Tree
133	Fabaceae	*Prosopis cineraria*	Tree
134	Fabaceae	*Prosopis juliflora*	Tree
135	Fabaceae	*Pterocarpus marsupium*	Tree
136	Fabaceae	*Samanea saman*	Tree
137	Fabaceae	*Saraca indica*	Tree
138	Fabaceae	*Senna siamea*	Tree
139	Fabaceae	*Senna spectabilis*	Tree
140	Fabaceae	*Sesbania grandiflora*	Tree
141	Fabaceae	*Sesbania sesban*	Tree
142	Fabaceae	*Tamarindus indica*	Tree
143	Fabaceae	*Hardwickia binata*	Tree
144	Fabaceae	*Senna surattensis*	Tree
145	Fabaceae	*Kavalana urens*	Tree
146	Lamiaceae	*Clerodendrum phlomidis*	Tree
147	Lamiaceae	*Colebrookea oppositifolia*	Tree
148	Lamiaceae	*Gmelina arborea*	Tree
149	Lamiaceae	*Tectona grandis*	Tree
150	Lamiaceae	*Vitex negundo*	Tree

S. No.	Family Name	Scientific Name	Habit
151	Lauraceae	*Cinnamomum tamala*	Tree
152	Lauraceae	*Cinnamomum verum*	Tree
153	Lauraceae	*Litsea glutinosa*	Tree
154	Lecythidaceae	*Barringtonia acutangula*	Tree
155	Lecythidaceae	*Careya arborea*	Tree
156	Lecythidaceae	*Couroupita guianensis*	Tree
157	Leguminosae	*Acacia farnesiana*	Tree
158	Loganiaceae	*Strychnos nux-vomica*	Tree
159	Lythraceae	*Lagerstroemia indica*	Tree
160	Lythraceae	*Lagerstroemia parviflora*	Tree
161	Lythraceae	*Lagerstroemia speciosa*	Tree
162	Lythraceae	*Lawsonia inermis*	Tree
163	Lythraceae	*Punica granatum*	Tree
164	Magnoliaceae	*Magnolia champaca*	Tree
165	Malpighiaceae	*Malpighia glabra*	Tree
166	Malvaceae	*Adansonia digitata*	Tree
167	Malvaceae	*Bombax ceiba*	Tree
168	Malvaceae	*Ceiba pentandra*	Tree
169	Malvaceae	*Chorisia speciosa*	Tree
170	Malvaceae	*Dombeya cayeuxii*	Tree
171	Malvaceae	*Eriolaena hookeriana*	Tree
172	Malvaceae	*Firmiana colorata*	Tree
173	Malvaceae	*Grewia asiatica*	Tree
174	Malvaceae	*Grewia elastica*	Tree
175	Malvaceae	*Grewia serrulata*	Tree
176	Malvaceae	*Guazuma ulmifolia*	Tree
177	Malvaceae	*Hibiscus rosa*	Tree
178	Malvaceae	*Kleinhovia hospita*	Tree
179	Malvaceae	*Kydia calycina*	Tree
180	Malvaceae	*Pterospermum acerifolium*	Tree
181	Malvaceae	*Pterygota alata*	Tree
182	Malvaceae	*Sterculia foetida*	Tree
183	Malvaceae	*Thespesia populnea*	Tree
184	Malvaceae	*Grewia tiliifolia*	Tree
185	Meliaceae	*Azadirachta indica*	Tree
186	Meliaceae	*Chukrasia tabularis*	Tree
187	Meliaceae	*Melia azedarach*	Tree
188	Meliaceae	*Soymida Febrifuga*	Tree
189	Meliaceae	*Swietenia macrophylla*	Tree
190	Meliaceae	*Swietenia mahogani*	Tree
191	Meliaceae	*Toona ciliata*	Tree
192	Moraceae	*Artocarpus altilis*	Tree
193	Moraceae	*Artocarpus heterophyllus*	Tree
194	Moraceae	*Broussonetia papyrifera*	Tree
195	Moraceae	*Ficus benghalensis*	Tree
196	Moraceae	*Ficus benjamina*	Tree
197	Moraceae	*Ficus carica*	Tree
198	Moraceae	*Ficus elestica*	Tree
199	Moraceae	*Ficus glomerata*	Tree
200	Moraceae	*Ficus hispida*	Tree

S. No.	Family Name	Scientific Name	Habit
201	Moraceae	*Ficus krishnae*	Tree
202	Moraceae	*Ficus microcarpa*	Tree
203	Moraceae	*Ficus mollis*	Tree
204	Moraceae	*Ficus racemosa*	Tree
205	Moraceae	*Ficus religiosa*	Tree
206	Moraceae	*Ficus virens*	Tree
207	Moraceae	*Morus alba*	Tree
208	Moraceae	*Morus indica*	Tree
209	Moringaceae	*Moringa oleifera*	Tree
210	Muntingiaceae	*Muntingia calabura*	Tree
211	Myrsinaceae	*Embelia robusta*	Tree
212	Myrtaceae	*Callistemon lanceolatus*	Tree
213	Myrtaceae	*Corymbia citriodora*	Tree
214	Myrtaceae	*Eucalyptus globulus*	Tree
215	Myrtaceae	*Melaleuca bracteata*	Tree
216	Myrtaceae	*Psidium guajava*	Tree
217	Myrtaceae	*Syzygium cumini*	Tree
218	Myrtaceae	*Syzygium salicifolium*	Tree
219	Myrtaceae	*Eucalyptus tereticornis*	Tree
220	Oleaceae	*Nyctanthes arbor-tristis*	Tree
221	Oleaceae	*Schrebera swietenioides*	Tree
222	Oxalidaceae	*Averrhoa carambola*	Tree
223	Phyllanthaceae	*Antidesma ghaesembilla*	Tree
224	Phyllanthaceae	*Bridelia retusa*	Tree
225	Phyllanthaceae	*Cleistanthus collinus*	Tree
226	Phyllanthaceae	*Phyllanthus acidus*	Tree
227	Phyllanthaceae	*Phyllanthus emblica*	Tree
228	Phyllanthaceae	*Phyllanthus reticulata*	Tree
229	Proteaceae	*Grevillea robusta*	Tree
230	Putranjivaceae	*Putranjiva roxburghii*	Tree
231	Rhamnaceae	*Zizyphus mauritiana*	Tree
232	Rhamnaceae	*Zizyphus xylopyra*	Tree
233	Rosaceae	*Eriobotrya japonica*	Tree
234	Rubiaceae	*Adina cordifolia*	Tree
235	Rubiaceae	*Coffea arabica*	Tree
236	Rubiaceae	*Gardenia gummifera*	Tree
237	Rubiaceae	*Gardenia latifolia*	Tree
238	Rubiaceae	*Gardenia lucida*	Tree
239	Rubiaceae	*Gardenia resinifera*	Tree
240	Rubiaceae	*Haldina cordifolia*	Tree
241	Rubiaceae	*Hymenodictyon orixense*	Tree
242	Rubiaceae	*Ixora arborea*	Tree
243	Rubiaceae	*Ixora parviflora*	Tree
244	Rubiaceae	*Mitragyna diversifolia*	Tree
245	Rubiaceae	*Mitragyna parvifolia*	Tree
246	Rubiaceae	*Morinda pubescens*	Tree
247	Rubiaceae	*Morinda tinctoria*	Tree
248	Rubiaceae	*Mussaenda philippica*	Tree
249	Rubiaceae	*Neolamarckia cadamba*	Tree
250	Rutaceae	*Aegle marmelos*	Tree
251	Rutaceae	*Chloroxylon swietenia*	Tree

S. No.	Family Name	Scientific Name	Habit
252	Rutaceae	*Citrus aurentium*	Tree
253	Rutaceae	*Citrus limon*	Tree
254	Rutaceae	*Citrus maxima*	Tree
255	Rutaceae	*Citrus medica*	Tree
256	Rutaceae	*Citrus sinensis*	Tree
257	Rutaceae	*Feronia acidissima*	Tree
258	Rutaceae	*Murraya koenigii*	Tree
259	Rutaceae	*Murraya paniculata*	Tree
260	Salicaceae	*Flacourtia indica*	Tree
261	Salicaceae	*Populus alba*	Tree
262	Salicaceae	*Salix tetrasperma*	Tree
263	Santalaceae	*Santalum album*	Tree
264	Sapindaceae	*Koelreuteria elegans*	Tree
265	Sapindaceae	*Sapindus saponaria*	Tree
266	Sapindaceae	*Schleichera oleosa*	Tree
267	Sapotaceae	*Madhuca longifolia*	Tree
268	Sapotaceae	*Manilkara hexandra*	Tree
269	Sapotaceae	*Manilkara zapota*	Tree
270	Sapotaceae	*Mimusops elengi*	Tree
271	Simaroubaceae	*Ailanthus excelsa*	Tree
272	Solanaceae	*Solanum torvum*	Tree
273	Strelitziaceae	*Ravenala madagascariensis*	Tree
274	Ulmaceae	*Holoptelea integrifolia*	Tree
275	Verbenaceae	*Duranta repens*	Tree
276	Zygophyllaceae	*Balanites aegyptiaca*	Tree
277	Zygophyllaceae	*Balanites roxburghii*	Tree
278	Acanthaceae	*Petalidium barlerioides*	Shrub
279	Apocynaceae	*Holarrhena antidysenterica*	Shrub
280	Apocynaceae	*Calotropis procera*	Shrub
281	Apocynaceae	*Vinca rosea*	Shrub
282	Arecaceae	*Phoenix acaulis*	Shrub
283	Bignoneaceae	*Placourta rementci*	Shrub
284	Bignoniaceae	*Dolichandronew falcata*	Shrub
285	Celastraceae	*Gymnosporia montana*	Shrub
286	Cordiaceae	*Cordia macleodii*	Shrub
287	Fabaceae	*Indigofera tinctoria*	Shrub
288	Fabaceae	*Flemingia semialata*	Shrub
289	Fabaceae	*Desmodium pulchellum*	Shrub
290	Fabaceae	*Ougeinia dalbergioides*	Shrub
291	Lythraceae	*Woodfordia fruticosa*	Shrub
292	Malvaceae	*Helicteres isora*	Shrub
293	Malvaceae	*Grewia hirsuta*	Shrub
294	Phyllanthaceae	*Emblica officinalis*	Shrub
295	Rubiaceae	*Gardenia turgida*	Shrub
296	Rubiaceae	*Randia dumetorum*	Shrub
297	Solanaceae	*Datura stramonium*	Shrub
298	Solanaceae	*Withania somnifera*	Shrub
299	Verbenaceae	*Lantana indica*	Shrub
300	Fabaceae	*Cassia tora*	Herb
301	Fabaceae	*Mimosa pudica*	Herb
302	Phyllanthaceae	*Phyllanthus niruri*	Herb

S. No.	Family Name	Scientific Name	Habit
303	Poaceae	*Sorghum halepense*	Herb
304	Poaceae	*Vetiveria zizanioides*	Herb
305	Poaceae	*Dichanthium annulatum*	Herb
306	Poaceae	*Iseilema laxum*	Herb
307	Poaceae	*Heteropogon contortus*	Herb
308	Poaceae	*Dendrocalamus strictus*	Herb
309	Poaceae	*Cymbopogon martini*	Herb
310	Poaceae	*Saccharum spontaneum*	Herb
311	Poaceae	*Apluda aristata*	Herb
312	Rubiaceae	*Randia uliginosa*	Herb
313	Acanthaceae	*Hygrophila auriculata*	Macrophytes
314	Acanthaceae	*Hygrophila polysperma*	Macrophytes
315	Acanthaceae	*Justicia diffusa*	Macrophytes
316	Acanthaceae	*Justicia quinqueangularis*	Macrophytes
317	Aizoaceae	*Trianthema portulacastrum*	Macrophytes
318	Alismataceae	*Alisma plantago-aquatica*	Macrophytes
319	Alismataceae	*Sagittaria guayanensis*	Macrophytes
320	Amaranthaceae	*Alternanthera pungens*	Macrophytes
321	Amaranthaceae	*Alternanthera sessilis*	Macrophytes
322	Amaranthaceae	*Celosia argentea*	Macrophytes
323	Amaranthaceae	*Digera muricata*	Macrophytes
324	Amaryllidaceae	*Crinum asiaticum*	Macrophytes
325	Amaryllidaceae	*Crinum viviparum*	Macrophytes
326	Apiaceae	*Centella asiatica*	Macrophytes
327	Apocynaceae	*Oxystelma esculentum*	Macrophytes
328	Aponogetonaceae	*Aponogeton natans*	Macrophytes
329	Araceae	*Colocasia esculenta*	Macrophytes
330	Araceae	*Lemna perpusilla*	Macrophytes
331	Araceae	*Pistia stratiotes*	Macrophytes
332	Araceae	*Spirodela polyrrhiza*	Macrophytes
333	Araceae	*Cryptocoryne retrospiralis*	Macrophytes
334	Araliaceae	*Hydrocotyle sibthorpioides*	Macrophytes
335	Asteraceae	*Caesulia axillaris*	Macrophytes
336	Asteraceae	*Centipeda minima*	Macrophytes
337	Asteraceae	*Cyathocline purpurea*	Macrophytes
338	Asteraceae	*Eclipta prostrata*	Macrophytes
339	Asteraceae	*Emilia sonchifolia*	Macrophytes
340	Asteraceae	*Enydra fluctuans*	Macrophytes
341	Asteraceae	*Grangea maderaspatana*	Macrophytes
342	Asteraceae	*Sphaeranthus indicus*	Macrophytes
343	Asteraceae	*Spilanthes paniculata*	Macrophytes
344	Asteraceae	*Wedelia chinensis*	Macrophytes
345	Athyriaceae	*Diplazium esculentum*	Macrophytes
346	Boraginaceae	*Heliotropium ovalifolium*	Macrophytes
347	Brassicaceae	*Rorippa indica*	Macrophytes
348	Burmanniaceae	*Burmannia coelestis*	Macrophytes
349	Campanulaceae	*Wahlenbergia marginata*	Macrophytes
350	Caryophyllaceae	*Polycarpon prostratum*	Macrophytes
351	Ceratophyllaceae	*Ceratophyllum demersum*	Macrophytes
352	Chenopodiaceae	*Chenopodium album*	Macrophytes
353	Chenopodiaceae	*Chenopodium murale*	Macrophytes

S. No.	Family Name	Scientific Name	Habit
354	Cleomaceae	*Cleome chelidonii*	Macrophytes
355	Coldeniaceae	*Coldenia procumbens*	Macrophytes
356	Commelinaceae	*Commelina attenuata*	Macrophytes
357	Commelinaceae	*Commelina benghalensis*	Macrophytes
358	Commelinaceae	*Commelina diffusa*	Macrophytes
359	Commelinaceae	*Commelina erecta*	Macrophytes
360	Commelinaceae	*Commelina undulata*	Macrophytes
361	Commelinaceae	*Cyanotis axillaris*	Macrophytes
362	Commelinaceae	*Floscopa scandens*	Macrophytes
363	Commelinaceae	*Murdannia japonica*	Macrophytes
364	Commelinaceae	*Murdannia nudiflora*	Macrophytes
365	Convolvulaceae	*Ipomoea aquatica*	Macrophytes
366	Convolvulaceae	*Ipomoea carnea*	Macrophytes
367	Cymodoceaceae	*Ruppia maritima*	Macrophytes
368	Cyperaceae	*Carex fedia*	Macrophytes
369	Cyperaceae	*Cyperus iria*	Macrophytes
370	Cyperaceae	*Cyperus rotundus*	Macrophytes
371	Cyperaceae	*Eleocharis atropurpurea*	Macrophytes
372	Cyperaceae	*Fimbristylis bisumbellata*	Macrophytes
373	Cyperaceae	*Kyllinga triceps*	Macrophytes
374	Cyperaceae	*Lipocarpha chinensis*	Macrophytes
375	Cyperaceae	*Pycreus sanguinolentus*	Macrophytes
376	Cyperaceae	*Scirpus littoralis*	Macrophytes
377	Droseraceae	*Drosera indica*	Macrophytes
378	Ehretiaceae	*Rotula aquatica*	Macrophytes
379	Elatinaceae	*Bergia ammannioides*	Macrophytes
380	Elatinaceae	*Bergia capensis*	Macrophytes
381	Eriocaulaceae	*Eriocaulon cinereum*	Macrophytes
382	Eriocaulaceae	*Eriocaulon quinquangulare*	Macrophytes
383	Euphorbiaceae	*Baliospermum solanifolium*	Macrophytes
384	Euphorbiaceae	*Chrozophora plicata*	Macrophytes
385	Fabaceae	*Aeschynomene aspera*	Macrophytes
386	Fabaceae	*Aeschynomene indica*	Macrophytes
387	Fabaceae	*Alysicarpus vaginalis*	Macrophytes
388	Fabaceae	*Neptunia oleracea*	Macrophytes
389	Fabaceae	*Smithia conferta*	Macrophytes
390	Fabaceae	*Smithia sensitiva*	Macrophytes
391	Gentianaceae	*Canscora diffusa*	Macrophytes
392	Gentianaceae	*Exacum pedunculatum*	Macrophytes
393	Gentianaceae	*Hoppea dichotoma*	Macrophytes
394	Haloragaceae	*Myriophyllum tuberculatum*	Macrophytes
395	Heliotropiaceae	*Heliotropium curassavicum*	Macrophytes
396	Heliotropiaceae	*Heliotropium indicum*	Macrophytes
397	Heliotropiaceae	*Heliotropium supinum*	Macrophytes
398	Hyacinthaceae	*Scilla hyacinthina*	Macrophytes
399	Hydrocharitaceae	*Hydrilla verticillata*	Macrophytes
400	Hydrocharitaceae	*Hydrocharis morsus-ranae*	Macrophytes
401	Hydrocharitaceae	*Najas graminea*	Macrophytes
402	Hydrocharitaceae	*Najas indica*	Macrophytes
403	Hydrocharitaceae	*Najas marina*	Macrophytes
404	Hydrocharitaceae	*Nechamandra alternifolia*	Macrophytes

S. No.	Family Name	Scientific Name	Habit
405	Hydrocharitaceae	*Ottelia alismoides*	Macrophytes
406	Hydrocharitaceae	*Vallisneria natans*	Macrophytes
407	Hydrophyllaceae	*Hydrolea zeylanica*	Macrophytes
408	Isoetaceae	*Isoetes coromandelina*	Macrophytes
409	Juncaceae	*Juncus prismatocarpus*	Macrophytes
410	Lamiaceae	*Leucas indica*	Macrophytes
411	Lamiaceae	*Pogostemon glabe*	Macrophytes
412	Lamiaceae	*Salvia plebeia*	Macrophytes
413	Lemnaceae	*Wolffia globosa*	Macrophytes
414	Lentibulariaceae	*tricularia aurea*	Macrophytes
415	Lentibulariaceae	*Utricularia stellaris*	Macrophytes
416	Lentibulariaceae	*Utricularia uliginosa*	Macrophytes
417	Linderniaceae	*Lindernia anagallis*	Macrophytes
418	Linderniaceae	*Lindernia ciliata*	Macrophytes
419	Linderniaceae	*Lindernia crustacea*	Macrophytes
420	Lythraceae	*Ammannia baccifera*	Macrophytes
421	Lythraceae	*Ammannia multiflora*	Macrophytes
422	Lythraceae	*Rotala indica*	Macrophytes
423	Lythraceae	*Rotala rotundifolia*	Macrophytes
424	Lythraceae	*Trapa natans*	Macrophytes
425	Malvaceae	*Abutilon indicum*	Macrophytes
426	Malvaceae	*Corchorus capsularis*	Macrophytes
427	Malvaceae	*Corchorus olitorius*	Macrophytes
428	Malvaceae	*Corchorus trilocularis*	Macrophytes
429	Malvaceae	*Pentapetes phoenicea*	Macrophytes
430	Menyanthaceae	*Nymphoides hydrophylla*	Macrophytes
431	Menyanthaceae	*Nymphoides indica*	Macrophytes
432	Molluginaceae	*Glinus lotoides*	Macrophytes
433	Molluginaceae	*Glinus oppositifolius*	Macrophytes
434	Molluginaceae	*Mollugo pentaphylla*	Macrophytes
435	Nelumbonaceae	*Nelumbo nucifera*	Macrophytes
436	Nymphaeaceae	*Nymphaea nouchali*	Macrophytes
437	Nymphaeaceae	*Nymphaea pubescens*	Macrophytes
438	Onagraceae	*Ludwigia adscendens*	Macrophytes
439	Onagraceae	*Ludwigia octovalvis*	Macrophytes
440	Onagraceae	*Ludwigia perennis*	Macrophytes
441	Onagraceae	*Ludwigia prostrata*	Macrophytes
442	Orobanchaceae	*Striga angustifolia*	Macrophytes
443	Pandanaceae	*Pandanus odorifer*	Macrophytes
444	Phyllanthaceae	*Phyllanthus reticulatus*	Macrophytes
445	Phyllanthaceae	*Phyllanthus rotundifolius*	Macrophytes
446	Phyllanthaceae	*Phyllanthus urinaria*	Macrophytes
447	Phyllanthaceae	*Phyllanthus virgatus*	Macrophytes
448	Plantaginaceae	*Bacopa monnieri*	Macrophytes
449	Plantaginaceae	*Dopatrium junceum*	Macrophytes
450	Plantaginaceae	*Limnophila aromatica*	Macrophytes
451	Plantaginaceae	*Scoparia dulcis*	Macrophytes
452	Plantaginaceae	*Veronica anagallis aquatica*	Macrophytes
453	Poaceae	*Coix lacryma jobi*	Macrophytes
454	Poaceae	*Echinochloa colona*	Macrophytes
455	Poaceae	*Eragrostis amabilis*	Macrophytes
456	Poaceae	*Eragrostis pilosa*	Macrophytes

S. No.	Family Name	Scientific Name	Habit
457	Poaceae	*Eragrostis procera*	Macrophytes
458	Poaceae	*Eragrostis unioloides*	Macrophytes
459	Poaceae	*Leersia hexandra*	Macrophytes
460	Poaceae	*Panicum sanguinale*	Macrophytes
461	Poaceae	*Paspalidium flavidum*	Macrophytes
462	Poaceae	*Perotis indica*	Macrophytes
463	Poaceae	*Saccharum bengalense*	Macrophytes
464	Polygonaceae	*Persicaria barbata*	Macrophytes
465	Polygonaceae	*Persicaria glabra*	Macrophytes
466	Polygonaceae	*Persicaria hydropiper*	Macrophytes
467	Polygonaceae	*Persicaria pulchra*	Macrophytes
468	Polygonaceae	*Polygonum plebeium*	Macrophytes
469	Polygonaceae	*Rumex dentatus*	Macrophytes
470	Pontederiaceae	*Eichhornia crassipes*	Macrophytes
471	Pontederiaceae	*Monochoria hastata*	Macrophytes
472	Portulacaceae	*Portulaca oleracea*	Macrophytes
473	Portulacaceae	*Portulaca quadrifida*	Macrophytes
474	Potamogetonaceae	*Potamogeton crispus*	Macrophytes
475	Potamogetonaceae	*Potamogeton natans*	Macrophytes
476	Potamogetonaceae	*Potamogeton nodosus*	Macrophytes
477	Potamogetonaceae	*Potamogeton pectinatus*	Macrophytes
478	Pteridaceae	*Ceratopteris thalictroides*	Macrophytes
479	Ranunculaceae	*Ranunculus sceleratus*	Macrophytes
480	Rubiaceae	*Dentella repens*	Macrophytes
481	Salviniaceae	*Salvinia natans*	Macrophytes
482	Scrophulariaceae	*Stemodia viscosa*	Macrophytes
483	Solanaceae	*Physalis minima*	Macrophytes
484	Sphenocleaceae	*Sphenoclea zeylanica*	Macrophytes
485	Thelypteridaceae	*Ampelopteris prolifera*	Macrophytes
486	Typhaceae	*Typha domingensis*	Macrophytes
487	Verbenaceae	*Phyla nodiflora*	Macrophytes
488	Xyridaceae	*Xyris indica*	Macrophytes

Table 13: List of Butterfly species in Bhopal city

S. No.	Family	Scientific Name
1	Hesperiidae	*Badamia exclamationis*
2	Hesperiidae	*Borbo bevani*
3	Hesperiidae	*Borbo cinnara*
4	Hesperiidae	*Hasora chromus*
5	Hesperiidae	*Pelopidas mathias*
6	Hesperiidae	*Sarangesa purendra*
7	Hesperiidae	*Spialia galba*
8	Hesperiidae	*Suastus gremius*
9	Hesperiidae	*Udaspes folus*
10	Lycaenidae	*Acytolepis puspa*
11	Lycaenidae	*Caleta decidia*
12	Lycaenidae	*Castalius rosimon*
13	Lycaenidae	*Catochrysops strabo*
14	Lycaenidae	*Chilades lajus*
15	Lycaenidae	*Chilades parrhasius*
16	Lycaenidae	*Chilodes pandava*
17	Lycaenidae	*Cigaritis vulcanus*
18	Lycaenidae	*Deudorix isocrates*
19	Lycaenidae	*Euchrysops cnejus*
20	Lycaenidae	*Freyeria trochylus*
21	Lycaenidae	*Jamides bochus*
22	Lycaenidae	*Jamides celeno*
23	Lycaenidae	*Lampides boeticus*
24	Lycaenidae	*Leptotes plinius*
25	Lycaenidae	*Prosotas nora*
26	Lycaenidae	*Pseudozizeeria maha*
27	Lycaenidae	*Rapala iarbus*
28	Lycaenidae	*Talicada nyseus*
29	Lycaenidae	*Tarucus extricatus*
30	Lycaenidae	*Zizeeria karsandra*
31	Lycaenidae	*Zizina otis*
32	Lycaenidae	*Zizula hylax*
33	Nymphalidae	*Acraea violae*
34	Nymphalidae	*Ariadne merione*
35	Nymphalidae	*Danaus chrysippus*
36	Nymphalidae	*Danaus genutia*
37	Nymphalidae	*Euploea core*
38	Nymphalidae	*Euthalia aconthea*
39	Nymphalidae	*Euthalia nais*
40	Nymphalidae	*Hypolimnas bolina*
41	Nymphalidae	*Hypolimnas misippus*
42	Nymphalidae	*Junonia atlites*
43	Nymphalidae	*Junonia hierta*
44	Nymphalidae	*Junonia iphita*
45	Nymphalidae	*Junonia lemonias*
46	Nymphalidae	*Junonia orithya*
47	Nymphalidae	*Junonia almana*
48	Nymphalidae	*Melanitis leda*
49	Nymphalidae	*Melanitis phedima*

S. No.	Family	Scientific Name
50	Nymphalidae	*Moduza procris*
51	Nymphalidae	*Mycalesis mineus*
52	Nymphalidae	*Mycalesis perseus*
53	Nymphalidae	*Neptis hylas*
54	Nymphalidae	*Parantica aglea*
55	Nymphalidae	*Phalanta phalantha*
56	Nymphalidae	*Polyura athamas*
57	Nymphalidae	*Tirumala limniace*
58	Nymphalidae	*Vanessa cardui*
59	Nymphalidae	*Ypthima asterope*
60	Nymphalidae	*Ypthima baldus*
61	Nymphalidae	*Ypthima huebneri*
62	Papilionidae	*Atrophaneura hector*
63	Papilionidae	*Graphium nomius*
64	Papilionidae	*Pachliopta aristolochiae*
65	Papilionidae	*Papilio clytia*
66	Papilionidae	*Papilio demoleus*
67	Papilionidae	*Papilio polytes*
68	Pieridae	*Appias albina*
69	Pieridae	*Belenois aurota*
70	Pieridae	*Catopsilia pomona*
71	Pieridae	*Catopsilia pyranthe pyranthe*
72	Pieridae	*Cepora nerissa*
73	Pieridae	*Colotis eucharis*
74	Pieridae	*Delias eucharis*
75	Pieridae	*Eurema andersonii*
76	Pieridae	*Eurema blanda*
77	Pieridae	*Eurema brigitta*
78	Pieridae	*Eurema hecabe*
79	Pieridae	*Eurema laeta*
80	Pieridae	*Ixias marianne*
81	Pieridae	*Ixias pyrene*
82	Pieridae	*Leptosia nina*
83	Pieridae	*Pareronia valeria*
84	Pieridae	*Pieris brassicae*
85	Riodinidae	*Abisara echerius*

Table 14: List of Herpetofauna species in Bhopal city

S. No.	Family Name	Common Name	Scientific Name
1	Agamidae	Indian Garden Lizard	*Calotes versicolor*
2	Boidae	Common Sand Boa	*Eryx conicus*
3	Boidae	Red Sand Boa	*Eryx johnii*
4	Chamaeleonidae	Indian Chameleon	*Chamaeleo zeylanicus*
5	Colubridae	Banded Kukri Snake	*Oligodon amensis*
6	Colubridae	Banded Racer	*Argyrogene fasciolatus*
7	Colubridae	Buff-Striped Keelback	*Amphiesma stolata*
8	Colubridae	Checkered Keelback Water Snake	*Xenochrophis piscator*
9	Colubridae	Common Bronze Back	*Dendrelaphis tristis*
10	Colubridae	Common trinket	*Coelognathus helena*
11	Colubridae	Common Wolf Snake	*Lycodon aulicus*
12	Colubridae	Indian Rat snake	*Ptyas mucosa*
13	Colubridae	Olive Keelback water snake	*Atretium schistosum*
14	Crocodylidae	Mugger Crocodile	*Crocodylus palustris*
15	Elapidae	Common Indian Krait	*Bungarus caeruleus*
16	Elapidae	King Cobra	*Ophiophagus hannah*
17	Elapidae	Spectacled Cobra	*Naja naja*
18	Gavialidae	Gharial	*Gavialis gangeticus*
19	Gekkonidae	Brook's House Gecko	*Hemidactylus brookii*
20	Gekkonidae	House Gecko	*Hemidactylus flaviviridis*
21	Gekkonidae	South Asian House Gecko	*Hemidactylus frenatus*
22	Geoemydidae	Indian Roofed Turtle	*Pangshura tecta*
23	Pythonidae	Indian rock Python	*Python molurus*
24	Scincidae	Bronze Grass Skink	*Mabuya macularius*
25	Scincidae	Bronze Skink	*Eutropis macularia*
26	Scincidae	Keeled Grass Skink	*Eutropis carinata*
27	Scincidae	Lined Supple Skink	*Lygosoma lineata*
28	Scincidae	Punctate Supple Skink	*Lygosoma punctata*
29	Scincidae	Snake Skink	*Lygosoma puncatatus*
30	Scincidae	White-spotted Supple Skink	*Lygosoma albopunctata*
31	Trionychidae	Indian Flap-shelled Turtle	*Lissemys punctata*
32	Trionychidae	Indian Peacock Soft-shelled Turtle	*Nilssonia hurum*
33	Typhlopidae	Brahminy Worm snake	*Ramphotyphlops braminus*
34	Varanidae	Bengal Monitor	*Varanus bengalensis*
35	Viperidae	Echis carinatus	*Echis carinatus*
36	Viperidae	Russell's Viper	*Daboia russelii*

Table 15: List of Fish species in Bhopal city

S. No.	Family Name	Scientific Name
1	Ambassidae	*Chanda nama*
2	Ambassidae	*Chanda ranga*
3	Bagridae	*Mystus aor*
4	Bagridae	*Mystus bleekeri*
5	Bagridae	*Mystus seenghala*
6	Bagridae	*Mystus vittatus*
7	Belonidae	*Xenentodon cancila*
8	Channidae	*Channa marulius*
9	Channidae	*Channa punctatus*
10	Channidae	*Channa striatus*
11	Cichlidae	*Oreochromus mossambica*
12	Cichlidae	*Tilapia mossambica*
13	Clariidae	*Clarias batrachus*
14	Clariidae	*Clarius batrachus*
15	Cyprinidae	*Carrasius auratus*
16	Cyprinidae	*Catla catla*
17	Cyprinidae	*Cirrhinus mrigala*
18	Cyprinidae	*Cyprinus carpio communis*
19	Cyprinidae	*Cyprinus carpiospecularis*
20	Cyprinidae	*Garra lamta*
21	Cyprinidae	*Labeo boga*
22	Cyprinidae	*Labeo calbasu*
23	Cyprinidae	*Labeo gonius*
24	Cyprinidae	*Labeo rohita*
25	Cyprinidae	*Puntius amphibius*
26	Cyprinidae	*Puntius chola*
27	Cyprinidae	*Puntius punctatus*
28	Cyprinidae	*Puntius sarana*
29	Cyprinidae	*Puntius ticto*
30	Danionidae	*Amblypharyngodon mola*
31	Danionidae	*Rasbora daniconius*
32	Gobiidae	*Glossogobius giuris*
33	Heteropneustidae	*Heteropneustes fossilis*
34	Heteropneustidae	*Heteropneusts fossilis*
35	Mastacembelidae	*Mastacembelus armatus*
36	Nandidae	*Nandus nandus*
37	Notopteridae	*Notopterus notopterus*
38	Osphronemidae	*Trichogaster faciatus*
39	Siluridae	*Ompok bimaculatus*
40	Siluridae	*Ompok pabda*
41	Siluridae	*Wallago attu*
42	Xenocyprididae	*Ctenopharyngodon idellus*
43	Xenocyprididae	*Hypophthalmichthys sp.*
44	Xenocyprididae	*Hypophthalmichthys molitrix*

Table 16: List of Odonate species in Bhopal city

S. No.	Family Name	Scientific Name
1	Aeshnidae	*Anax indicus*
2	Coenagrionidae	*Agriocnemis pygmaea*
3	Coenagrionidae	*Ceriagrion coromandelianum*
4	Coenagrionidae	*Ischnura rubilio*
5	Coenagrionidae	*Ischnura senegalensis*
6	Coenagrionidae	*Pseudagrion rubriceps*
7	Coenagrionidae	*Pseudogrion decorum*
8	Lestidae	*Lestes concinnus*
9	Libellulidae	*Acisoma panorpoides*
10	Libellulidae	*Brachythemis contaminata*
11	Libellulidae	*Bradinopyga geminata*
12	Libellulidae	*Crocothemis servilia*
13	Libellulidae	*Diplacodes trivialis*
14	Libellulidae	*Indothemis carnatica*
15	Libellulidae	*Lathrecista asiatica*
16	Libellulidae	*Neurothemis tullia*
17	Libellulidae	*Orthetrum pruinosum*
18	Libellulidae	*Orthetrum sabina*
19	Libellulidae	*Pantala flavescens*
20	Libellulidae	*Potamarcha congener*
21	Libellulidae	*Rhyothemis variegata*
22	Libellulidae	*Trithemis aurora*
23	Platycnemididae	*Copera marginipes*

Table 17: List of Invasive Alien Plant species in Bhopal city

S. No.	Family Name	Scientific name
1	Acanthaceae	*Ruellia tuberosa*
2	Amaranthaceae	*Aerva javanica*
3	Amaranthaceae	*Alternanthera philoxeroides*
4	Amaranthaceae	*Alternanthera pungens*
5	Amaranthaceae	*Celosia argentea*
6	Apocynaceae	*Catharanthus pusillus*
7	Araceae	*Pistia stratiotes*
8	Arecaceae	*Borassus flabellifer*
9	Asclepiadaceae	*Asclepias curassavica*
10	Asclepiadaceae	*Cryptostegia grandiflora*
11	Asteraceae	*Acanthospermum hispidum*
12	Asteraceae	*Ageratum conyzoides*
13	Asteraceae	*Bidens pilosa*
14	Asteraceae	*Blainvillea acmella*
15	Asteraceae	*Blumea lacera*
16	Asteraceae	*Blumea obliqua*
17	Asteraceae	*Echinops echinatus*
18	Asteraceae	*Eclipta prostrata*
19	Asteraceae	*Emilia sonchifolia*
20	Asteraceae	*Flaveriatrinervis (Spreng*
21	Asteraceae	*Glossocardia bosvallea*
22	Asteraceae	*Grangea maderaspatana*

S. No.	Family Name	Scientific name
23	Asteraceae	*Lagascea mollis*
24	Asteraceae	*Parthenium hysterophorus*
25	Asteraceae	*Sonchus asper*
26	Asteraceae	*Sonchus oleracea*
27	Asteraceae	*Tridax procumbens*
28	Asteraceae	*Xanthium strumarium*
29	Balsaminaceae	*Impatiens balsamina*
30	Cactaceae	*Opuntia stricta*
31	Caesalpiniaceae	*Cassia occidentalisL*
32	Caesalpiniaceae	*Cassia absus*
33	Caesalpiniaceae	*Cassia alata*
34	Caesalpiniaceae	*Cassia obtusifolia*
35	Caesalpiniaceae	*Cassia pumila*
36	Caesalpiniaceae	*Cassia tora*
37	Cleomaceae	*Cleome gynandra*
38	Cleomaceae	*Cleome viscosa*
39	Convolvulaceae	*Ecolvulus nummularius*
40	Convolvulaceae	*Ipomoea carnea*
41	Convolvulaceae	*Ipomoea hederifolia*
42	Convolvulaceae	*Ipomoea pes-tigridis*
43	Convolvulaceae	*Ipomoea quamoclit*
44	Cuscutaceae	*Cuscuta chinensis*
45	Cyperaceae	*Cyperus iria*
46	Euphorbiaceae	*Chrozophora rottleri*
47	Euphorbiaceae	*Euphorbia heterophylla*
48	Euphorbiaceae	*Synadenium grantii*
49	Lamiaceae	*Hyptis suaveolens*
50	Lamiaceae	*Leonatis nepetiifolia*
51	Lamiaceae	*Ocimum americanum*
52	Liliaceae	*Asphodelus tenuifolius*
53	Malvaceae	*Malvastrum coromandelianum*
54	Malvaceae	*Sida acuta*
55	Malvaceae	*Urena lobata*
56	Mimosaceae	*Acacia farnesiana*
57	Mimosaceae	*Lcucaena leucocephala*
58	Mimosaceae	*Mimosa pudica*
59	Mimosaceae	*Prosopis juliflora*
60	Nyctaginaceae	*Mirabilis jalapa*
61	Onagraceae	*Ludwigia adscendens*
62	Onagraceae	*Ludwigia perennis*
63	Papaveraceae	*Argemone mexicana*
64	Papilionaceae	*Indigofera astragalina*
65	Papilionaceae	*Indigofera glandulosa*
66	Papilionaceae	*Indigofera linifolia*
67	Papilionaceae	*Indigofera trita*
68	Papilionaceae	*Melilotus alba*
69	Passifloraceae	*Passiflora foetida*
70	Pedaliaceae	*Martynia armua*
71	Piperaceae	*Peperomia pellucida*
72	Poaceae	*Chloris barbata*
73	Poaceae	*Echinocloa colona*
74	Poaceae	*Imperata cylindrica*

S. No.	Family Name	Scientific name
75	Polygonaceae	*Antigonon leptopus*
76	Pontederiaceae	*Eichhornia crassipes*
77	Pontederiaceae	*Monochoria vaginalis*
78	Portulacaceae	*Portulaca oleracea*
79	Rubiaceae	*Spermacoce hispida*
80	Scrophulariaceae	*Macrodonia procumbens*
81	Scrophulariaceae	*Scoparia dulcis*
82	Scrophulariaceae	*Torenia fournieri*
83	Solanaceae	*Datura innoxia*
84	Solanaceae	*Datura metel*
85	Solanaceae	*Nicotiana plumbaginifolia*
86	Solanaceae	*Physalis pruinosa*
87	Solanaceae	*Solanum seaforthianum*
88	Sterculiaceae	*Melochia corchorifolia*
89	Tiliaceae	*Corchorus aestuans*
90	Tiliaceae	*Corchorus fascicularis*
91	Tiliaceae	*Corchorus tridens*
92	Tiliaceae	*Triumfetta rhomboidea*
93	Turneraceae	*Turner aulmifolia*
94	Typhaceae	*Typha angustata*
95	Urticaceae	*Pilea microphylla*
96	Verbenaceae	*Lantana camara*
97	Verbenaceae	*Stachytarpheta jamaicensis*

ANNEXURE IV - List of Parks in Bhopal City

Table 18: List of Parks in Bhopal city

S.No.	Name of Park	Area in ha
1	Mayur Park	3.20
2	Guru Govind Singh Park (Ekant Park)	60.00
3	Priyadarshini Park	3.24
4	Park in E-1 -Arera Colony	0.57
5	Park in E-2 -Arera Colony	0.03
6	Park in E-4 -Arera Colony	0.14
7	Meera Vatika (Arera Colony E-5)	0.14
8	Borvan, Bairagarh	72.84
9	Nagar Van, Aiims Bhopal	3.62
10	Dr. Shyama Prasad Mukharji Park	7.08
11	Swarna Jayanti Park	41.48
12	Morvan, Shahpura Pahadi	50.24
13	Sardar Vallabh Bhai Patel Park	3.64
14	Jawahar Bal Udhyaan Park	10.31
15	Bhagwan rishabdev Park	0.65
16	Park in D11/5, Chaar Imli	1.00
17	Vaishali Nagar Park	0.20
18	Aradhna Nagar Park	0.25
19	Bhoj Vihar Nagar Van	3.00
20	Park in E-5 (Arera Colony) (1)	0.49
21	Park in E-5 (Arera Colony) (2)	0.42
22	Children Park, Shahpura	0.45
23	Chinar Park	16.20
24	Prakash Tarun Pushkar	0.32
25	Park of Kolar Tiraha	0.05
26	Park in Lalita Nagar	0.50
27	Park in Ganesh Mandir	0.84
28	Park near Scholar Home School	1.18
29	Park no 1, E-1 Arera Colony	1.87
30	Park no 2, E-1 Arera Colony	1.18
31	Park no 3, E-1 Arera Colony	1.36
32	park of Sacchidanand Nagar, Govindpura	0.90
33	Jamburi Maidan	21.70
34	Samardha Forest -laharpurEcopark	1696.31
35	Nagar van-Sanskar Valley Road, Bhopal	50.00
36	CTO Bairagarh Park	0.13
37	Mathai Nagar Park	0.08
38	Data Colony Park	0.09
39	Airport Naveen Park	1.11
40	Gulab Udhyaan Park, Bairagarh	1.49
41	Shri Visarjan Park	0.04
42	Gidwai Park	0.44
43	Ekta Park	0.18
44	Dena Bank Park	0.42
45	Sadbhavna Park	0.23
46	Sadbhavna Park-2	0.06
47	Dr. Shankar Dayal Shamra Park	0.30

S.No.	Name of Park	Area in ha
48	Selfi Park	0.49
49	Karbala Park	0.14
50	Eqbal Maidan Park	0.31
51	Shaheed Bhagatsigh Park	0.07
52	Gitanjali Park	0.01
53	Nabab Ali Park	0.08
54	Green Park Green Colony IDG Bangla	0.01
55	Gautam Nagar Park	0.02
56	Santkanwar Ram Park	0.04
57	Mahak Park, Putlighar	0.01
58	Fitness center Park Kanji Camp	0.02
59	Purani Sindhi Colony Park	0.01
60	Rajeev Gandhi Bal Vihar J P Nagar	0.05
61	Arif Nagar Kachara Center	0.01
62	Chola VishramgrehSmaritiUdhyaa	0.02
63	Kushabhau Thakre Udhyaan behind Nadra Bus Stand	0.01
64	Shanti Nagar Park	0.02
65	Bal Vihar Udhyaan	0.05
66	Kudasiya Park	0.12
67	Ginnouri Park	0.01
68	Kamla Park	1.26
69	ITC Park	0.18
70	JainmuniStmbh Park	0.19
71	vardhmaan Park	1.93
72	Firdos Park	0.32
73	Kilol Park	0.69
74	Kushboo Park	0.69
75	Ansal Park	0.01
76	Shyamlahills Rest House Park	0.02
77	Vertical Garden Ravindra Bhawan	0.10
78	Jeevan Vatika	0.02
79	Loh Purush Park	0.07
80	Shitladevi Park	0.09
81	Vivekanand Park	0.36
82	Atal Park	0.03
83	Veerangna Park	0.03
84	Geetanjali Park	0.06
85	Yogakendra Park	0.06
86	Rivera Park near Mata Mandir	0.17
87	tulsi Park	0.06
88	Akansha Park	0.12
89	Selfie Point Park	0.12
90	Tarun Park	0.06
91	Jhalkari Bai Park	0.09
92	Swami Vivekanand near Central Library Park	0.05
93	Nandan Kanan Park	0.52
94	Ravishankar Shukl Park	0.08
95	Park in front of Urja Bhawan	0.33
96	Park in front of Sarojini Naidu	0.30
97	RBI Colony Park	0.04
98	Park in front of Pranami Mandir	0.27
99	Park in front of F-6/45, Chaar Imli	0.04

S.No.	Name of Park	Area in ha
100	Park in front of F-6/15, Chaar Imli	0.18
101	Karishma Park	0.03
102	Khatla Pura Park	6.30
103	Neelam Park	0.21
104	Swarna Jayanti Park	0.21
105	Yatayat Park	0.19
106	Nonihal Park	0.19
107	Yadgaar-e-shahjahani Park	1.66
108	ShantiparkPanchsheel Nagar	0.11
109	Harshvardhan Phase-1 Park	0.80
110	Patrkaar Colony Park	0.09
111	Pandit Dindayal Park	0.27
112	Shatabdi Park	0.43
113	Pappu Park	0.10
114	E-2 Park	0.29
115	Park near 1100 Quarter Tank	0.12
116	Atal Park	0.31
117	Basantkunj Park	0.59
118	Nupurkunj Park	0.13
119	Nishant Park / Handpump Park	0.12
120	Shankaracharya Nagar Park	0.79
121	Rajendra Nagar Park	0.13
122	Dashmesh Nagar Park	0.09
123	80 Feet Road Park	0.09
124	Abdul Kalam Park	0.07
125	Eishbagh Stadium Park	0.03
126	Baag-e-Tahir Park	0.41
127	Baag Dilkusha Park	0.08
128	Shaheed Bhagatsingh Park	1.19
129	Narmada Park	0.33
130	Pandit Dindayal Park-2	0.28
131	Padhnaabh Nagar Park	0.09
132	Abhiruchi Park-1	0.28
133	Abhiruchi Park-1	0.15
134	Govinda Garden	0.74
135	Veer Savarkar Park	0.18
136	Rachna Nagar Park	0.11
137	Charkha Park Vidya Nagar	0.01
138	Park in B sector near water tank, Vidya Nagar	0.05
139	A Sector Vidya Nagar Park	0.03
140	Purushottam Gaur Park Bagsevaniya	0.02
141	Amrai Park Bagsevaniya	1.39
142	Mahirishi Arvind Park, Arvind Vihar	0.14
143	Park near Water Tank	0.09
144	Krishna Vtika Park	0.05
145	Shiv Shakti Bal Park	0.10
146	Madhav Bal Park	0.40
147	Vivekannad Park, Ward no-57	0.09
148	Sadbhavana Park	0.09
149	Krishna Park	0.65
150	Park near ShivShakti Canal	0.09

S.No.	Name of Park	Area in ha
151	Amritpuri Park	0.06
152	Purushottam Gaur Park-2	0.45
153	Hara-Bhara Park	0.34
154	PushpaVatika Park	0.23
155	Apna Udhyaan Park	0.10
156	Annapurna Park	0.06
157	Pandit Dindayal Park	0.16
158	Shiv Mandir Park	0.45
159	K-Sector Park-1	0.19
160	K-Sector Park-2	0.20
161	Mangal Bhavan Park	0.10
162	Saryu Sarovar Park	2.06
163	Vivekanad Park, Ward no-68	0.04
164	Gas Rahat Udhyaan Housing Board	0.09
165	Mulla Colony Burhani Udhyaan	0.07
166	Vivekannad Park-2, Ward no-78	0.07
167	Vishwakarma Nagar Park-1, Ward no-78	0.03
168	Vishwakarma Nagar Park-2, Ward no-78	0.06
169	Amrit Yojna near ABM School	0.15
170	Amrit Yojna Police Line Park	0.27
171	Amrit Yojna Ward Office Park, Ward no-29	0.17
172	D-Sector Nehru Nagar Park	0.07
173	Gulab Udhyaan Mandakini Park	0.00
174	ShiridiPuram Park	0.00
175	DK-3 Park	0.00
176	Fine Evenue Park Phase-1	0.00
177	Amravihar Park-First	0.16
178	Amravihar Park-Second	0.09
179	Kanha Kunj Phase-1 Park	0.17
180	UdhyaanVatikaInayatpur	0.15

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

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Local Governments for Sustainability
SOUTH ASIA