CITY BIODIVERSITY INDEX
of
Pimpri Chinchwad Municipal Corporation
2019

Draft Report

Prepared by: Terracon Ecotech Pvt. Ltd

City Biodiversity Index

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TERRACON
Sustainable Solutions

Acknowledgement

We are thankful to Mr. Shravan Hardikar (I.A.S), Municipal Commissioner, Pimpri Chinchwad Municipal Corporation (PCMC) for assigning us this unique opportunity to formulate City Biodiversity Index for Pimpri Chinchwad city.

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We also thank our Dr. Ramesh Madav, Chairman, Dr. C.S.Latoo, Advisor of Terracon Ecotech Private Limited and Dr. Pravin Cholke, Assistant Professor, Anantrao Pawar College for their guidance, support and assistance in directing us to the appropriate resources for information.

Ashok Jain
Managing Director

Executive Summary

> 'Biological diversity' or 'Biodiversity' means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems.
>
> - Convention on Biological Diversity

According to a report submitted by the Population Division of the Department of Economics and Social Affairs of the United Nations, 2008 marked the year in which half the world's population resided in cities. This figure is expected to rise to 70% by the year 2030. In light of these findings by the UN, the Convention on Biological Diversity formulated the City Biodiversity Index (CBI) or the Singapore Index to assess the impact cities have on biodiversity and chart out measures to minimize negative impacts and promote enhancement of biodiversity. Singapore was the first city to conduct this exercise followed by a whole host of cities including London, Bangkok, Frankfurt and many others. Pimpri Chinchwad Municipal Corporation, decided to undertake this exercise of CBI to assess the status of biodiversity and conservation status in the city.

Pimpri Chinchwad was looked through the lens of three major components that form the Index– Native Biodiversity, Ecosystem Services and Governance and Management. Within every component there are different indicators to calculate the index. There are 23 indicators on which the CBI is calculated. Each indicator has a defined scoring criteria with max score of 4 points. Primary and Secondary surveys with spatial analysis tools (GIS) was used for calculations of the index.

It was observed that Pimpri Chinchwad has large proportion of natural areas i.e. 30.2% which includes a large number of grassland patches and three rivers Pawana, Indrayani and Mula present in the city. The city does not have any legally protected natural areas yet Pimpri Chinchwad support a very good diversity of species. The list of number of species is mentioned in the adjoining table. . Due to presence of these natural areas, the city scored well in the second component consisting of ecosystem services. It was found that the proportion of tree canopy over and permeable areas to terrestrial area stood at impressive figures of 17.7% and 47.7% respectively. The tree diversity was mainly found in the city centre as the areas at the outskirts of Pimpri Chinchwad is dominated by grasslands. Besides presence of the natural areas, PCMC has taken quite a lot of initiatives by developing parks and gardens for recreational purposes. There are 166.3 ha area of parks and garden in the city providing good recreational space for citizens.

Taxa	Number of Species
Birds	136
Butterflies	50
Freshwater fishes	47
Mammals	6
Trees	184
Shrubs	50
Herbs	182

The third component deals with governance and management of biodiversity by city administration. It is appreciable that PCMC has 3.9% of the total budget allotted for biodiversity. PCMC works in close associations with many NGO's, private companies' inter-governmental agency including forest department and Maharashtra State Biodiversity Board. PCMC also has Biodiversity Management Committee and is in process of preparing a Local Biodiversity Strategy and Action Plan for mainstreaming biodiversity in their planning process. PCMC currently needs to increase the number of outreach programmes or public awareness events to gain support of citizens in biodiversity conservation

Score of City Biodiversity Index

Core Components	Indicators	Obtained Score
Native Biodiversity	1. Proportion of Natural Areas in the City	4
	2. Connectivity Measures	4
	3. Native Biodiversity in Built Up Areas (Bird Species)	2
	4. Change in Number of Vascular Plant Species	4
	5. Change in Number of Bird Species	4
	6. Change in Number of Butterfly Species	4
	7. Change in Number of Species (any other taxonomic group selected)	4
	8. Change in Number of Species (any other taxonomic group selected)	4
	9. Proportion of Protected Natural Areas	0
	10. Proportion of Invasive Alien Species	3
Ecosystem Services provided by Biodiversity	11. Regulation of Quantity of Water	2
	12. Climate Regulation: Carbon Storage and Cooling Effect of Vegetation	1
	13. Recreation and Education: Area of Parks with Natural Areas	3
	14. Recreation and Education: Number of Formal Education Visits per Child Below 16 Years to Parks with Natural Areas per Year	1
Governance and Management of Biodiversity	15. Budget Allocated to Biodiversity	4
	16. Number of Biodiversity Projects Implemented by the City Annually	1
	17. Existence of Local Biodiversity Strategy and Action Plan	0
	18. Institutional Capacity: Number of Biodiversity Related Functions	4
	19. Institutional Capacity: Number of City or Local Government Agencies Involved in Inter-agency Cooperation Pertaining to Biodiversity Matters	1
	20. Participation and Partnership: Existence of Formal or Informal Public Consultation Process	0
	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	3
	22. Education and Awareness: Is Biodiversity or Nature Awareness Included in the School Curriculum	4
	23. Education and Awareness: Number of Outreach or Public Awareness Events Held in the City per Year	1
Native Biodiversity in the City (Sub-total for indicators 1-10)		33 points
Ecosystem Services provided by Biodiversity (Sub-total for indicators 11-14)		07 points
Governance and Management of Biodiversity (Sub-total for indicators 15-23)		18 points
Maximum Total:		58 Points
Each indicator has a max score of 4 points and Max total to be considered out of 92 points		

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Introduction

Urban biodiversity refers to the variety and variability among living organisms found in a city and the ecological systems in which they occur. Overall, urban biodiversity responds to a combination of biogeographic and anthropogenic factors, with a strong influence of the latter. As urban populations grow rapidly, the role that cities play in biodiversity conservation becomes increasingly relevant. Effective land use and management of natural ecosystems in urban areas can be beneficial to both residents and biodiversity that exist within and around the city. Hence, cities must be part of the solution to stem global biodiversity loss. It is commonly assumed that cities, being urban areas, are devoid of flora and fauna – the reality is that many cities have rich biodiversity, regardless of geographical location and climate.

> 'Biological diversity' or 'Biodiversity' means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems.
>
> - Convention on Biological Diversity

A monitoring tool (City Biodiversity Index) was developed in the year 2010 to assist local authorities for evaluation of their progress in urban biodiversity conservation. In recognition of Singapore's leadership and contributions in the development of the Index, the CBI was renamed the Singapore Index on Cities' Biodiversity, or Singapore Index. The City Biodiversity Index is such a tool, developed by the Convention on Biological Diversity (CBD) in collaboration with the National Parks' Board, Singapore (*NParks'*) and a host of international collaborators. The CBI serves as a self-assessment tool for cities to benchmark and monitor the progress of their biodiversity conservation efforts against their own individual baselines.

The City Biodiversity Index helps cities to accomplish their biodiversity goals via three interrelated mechanisms, which are vital to positive policy outcomes. First, the Index is a tool that allows cities to create baseline measurements of their current biodiversity profiles and then monitor and assess these over time. Secondly, it serves as a public platform upon which biodiversity awareness raising exercises can be launched. Finally, the Index acts as portal among various departments within city governance, academics, NGOs and the public, encouraging better communication, stronger networks and more co-operation, through data collection and sharing of mutual goals, which ultimately results in better policy outcomes. Indicators can serve as important policy tools in the measurement of economic, social and environmental variables.

It is recommended that subsequent applications of the City Biodiversity Index take place every three years to allow sufficient time for changes to have taken effect or the results of biodiversity conservation efforts to materialise

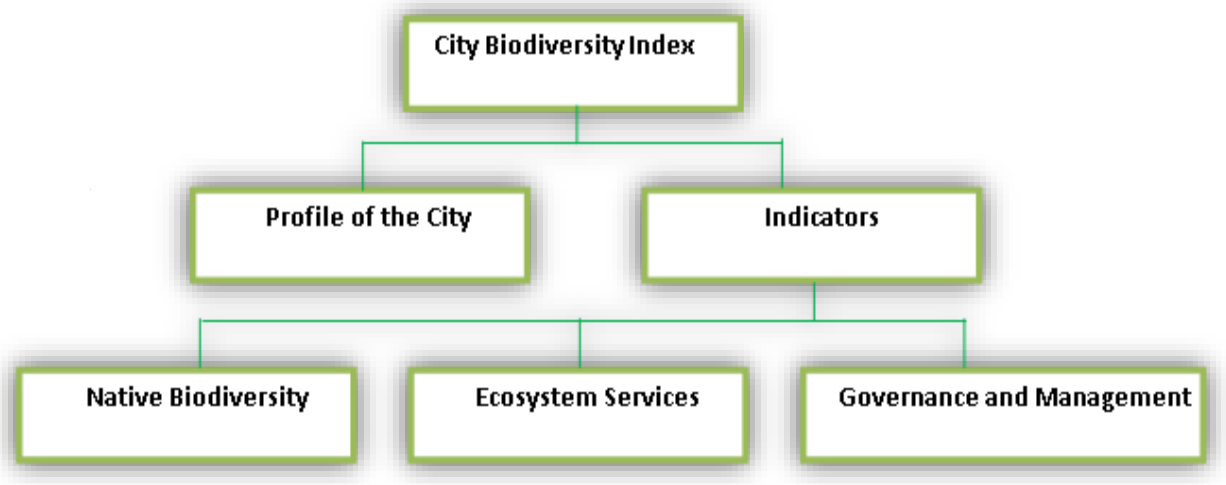

Figure 1: Components of City Biodiversity Index

Part 1: Profile of the City

Parameters to be considered for defining profile of the city include

1. **Location and Size:** Geographical coordinates (latitudes and longitudes); climate (temperate or tropical); rainfall/precipitation (range and average); including maps or satellite images where city boundaries are clearly defined
2. **Physical features of the city:** Geography, altitude, area of impermeable surfaces, information on brownfield sites, etc.
3. **Demographics:** Including total population and population density; the population of the region could also be included if appropriate and for the purpose of placing it in the regional context.
4. **Economic parameters:** Gross Domestic Product (GDP), Gross National Product (GNP), per capita income, key economic activities, drivers and pressures on biodiversity
5. **Biodiversity features:** Ecosystems within the city, species within the city, quantitative data on populations of key species of local importance, relevant qualitative biodiversity data
6. **Administration of biodiversity:** Relevant information includes agencies and departments responsible for biodiversity; how natural areas are protected (through national parks, nature reserves, forest reserves, secured areas, parks, etc.
7. **Links:** To relevant websites including the city's website, environmental or biodiversity themed websites, websites of agencies responsible for managing biodiversity

There are 23 indicators to calculate CBI. These 23 indicators are grouped into three main components viz. Native Biodiversity, Ecosystem Services provided by biodiversity and Governance and Management of biodiversity. Each indicator will be scored on a scale of 0 to 4. The CBI for a city will be calculated out of a total score of 92. Indicators included in the City Biodiversity Index includes:

A. **Native Biodiversity (10 indicators)**
B. **Ecosystem Services provided by Biodiversity (4 indicators)**
C. **Governance and Management of Biodiversity (9 indicators)**

Part 2: Indicators of City Biodiversity Index

Core Components	Indicators	Max Score
Native Biodiversity	1. Proportion of Natural Areas in the City	4 points
	2. Connectivity Measures	4 points
	3. Native Biodiversity in Built Up Areas (Bird Species)	4 points
	4. Change in Number of Vascular Plant Species	4 points
	5. Change in Number of Bird Species	4 points
	6. Change in Number of Butterfly Species	4 points
	7. Change in Number of Species (any other taxonomic group selected)	4 points
	8. Change in Number of Species (any other taxonomic group selected)	4 points
	9. Proportion of Protected Natural Areas	4 points
	10. Proportion of Invasive Alien Species	4 points
Ecosystem Services provided by Biodiversity	11. Regulation of Quantity of Water	4 points
	12. Climate Regulation: Carbon Storage and Cooling Effect of Vegetation	4 points
	13. Recreation and Education: Area of Parks with Natural Areas	4 points
	14. Recreation and Education: Number of Formal Education Visits per Child Below 16 Years to Parks with Natural Areas per Year	4 points
Governance and Management of Biodiversity	15. Budget Allocated to Biodiversity	4 points
	16. Number of Biodiversity Projects Implemented by the City Annually	4 points
	17. Existence of Local Biodiversity Strategy and Action Plan	4 points
	18. Institutional Capacity: Number of Biodiversity Related Functions	4 points
	19. Institutional Capacity: Number of City or Local Government Agencies Involved in Inter-agency Cooperation Pertaining to Biodiversity Matters	4 points
	20. Participation and Partnership: Existence of Formal or Informal Public Consultation Process	4 points
	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
	22. Education and Awareness: Is Biodiversity or Nature Awareness Included in the School Curriculum	4 points
	23. Education and Awareness: Number of Outreach or Public Awareness Events Held in the City per Year	4 points
	Native Biodiversity in the City (Sub-total for indicators 1-10)	40 points
	Ecosystem Services provided by Biodiversity (Sub-total for indicators 11-14)	16 points
	Governance and Management of Biodiversity (Sub-total for indicators 15-23)	36 Points
	Maximum Total:	92 Points

Methodology for Calculation of City Biodiversity Index

The City Biodiversity Index is calculated using the user manual for calculation of CBI provided by National Parks Board, Singapore. All the indicators can be calculated from either of the following three methods:

I. Spatial Analysis:

The satellite imagery of PCMC is processed for calculation of some indicators. The indicators calculated by spatial analysis is verified by ground thruthing at the site.

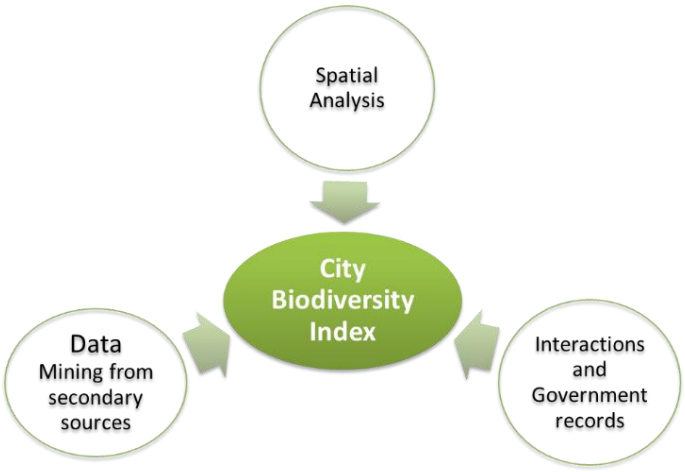

Figure 2: Methodology for CBI calculations

II. Data Mining:

It is a process of extracting data from existing databases. Data mining is carried out from the secondary resources viz. any scientific study carried out in the area viz. research papers, book publications, online portals etc.

III. Interactions and Government Records

Government records were collected viz. Environment Status report, etc. and formal interactions carried out with the Environment Department, Garden Department and local experts for documentation of existing knowledge and information related to biodiversity.

Methodology for City Biodiversity Index		
Spatial Analysis	**Data Mining from Secondary Resources**	**Interactions and Government Records**
A. Component 1 1. Proportion of Natural Areas 2. Connectivity Measures or Ecological Network to counter fragmentation 9. Proportion of protected Natural Areas **B. Component 2** 11. Regulation of Quantity of Water 12. Climate Regulation: Carbon Storage and Cooling Effect of Vegetation	**A. Component 1** 3. Native Biodiversity in Built-up area (Birds) 4-8. Change in number of native species) 10. Proportion of invasive alien species (as opposed to native species)	**B. Component 2** 13-14. Recreational and Education **C. Component 3** 15. Budget allocated to biodiversity 16. Number of biodiversity related projects implemented by the city annually 17. Existence of LBSAP 18-19. Institutional Capacity 20-21. Participation and Participation 22-23. Education and Awareness

Profile of the City

Pimpri Chinchwad city referred as the city of excellence is the twin city (Pimpri and Chinchwad) governed by the Pimpri Chinchwad Municipal Corporation (PCMC). The city is located on the Deccan plateau and is surrounded by hills. It is situated 530 m above the mean sea level. Pawana River traverses the city, while the Indrayani River flows through the north-western outskirts and Mula River on south forming a boundary of Pune and Pimpri Chinchwad cities. Pimpri Chinchwad Municipal Corporation has the suburbs of Pimpri, Nigdi, Akurdi, Chinchwad, Ravet, Bhosari, Pimple Gurav, Wakad, Pimple Saudagar, Pimple Nilakh, Thergaon, Charholi, Chikhli, Talawade, Mammardi, Dapodi, Moshi, Punawale and Sangvi. Pimpri-Chinchwad is major industrial centre of Pune region and also entire of the country. This has largely developed during the last four decade. Following are some facts and figures related to Pimpri Chinchwad city

Details	Information
Latitude	18°37′07.04″N
Longitude	73°48′13.43″E
Altitude	530 m above mean sea level
Total area (Excluding Defence Areas)	177.3 Sq. Km
Population (As per 2011 census)	17,29,359
Average rainfall	722 mm
Average Temperature	Max 40°C ; Min: 10°C

Geophysical Characters of Pimpri Chinchwad

The base rock found throughout the area is Deccan trap basalt. Two types of basalts are commonly seen. The non-vesicular type, which is hard, compact, tough and medium to fine grained is present in the areas around Chinchwad and Akurdi. Building stone is the only commercially important mineral available in this area and is extensively exploited. Along the road banks, the soil is fertile and hence it is suitable for agriculture. The soil in this area is generally brownish copper coloured towards the west and somewhat blackish in the east. The area is bounded by Indrayani and Pawana rivers. The catchment area of Pawana is about 505 sq.km.

Climate

Tropical climatic condition of the study area with their three distinct seasons: Summer, Monsoon and winter. The summer seasons are from March to May maximum temperature is 35◦C to 39◦C and hottest month is April. The Monsoon season in between June to September due to south west monsoon wind with receiving moderate rainfall and annual mean rainfall is 772 mm. The winter seasons from November to February. This weather is very agreeable the average temperature is between 10◦C to 29◦C the coldest month is December. Minimum temperature goes down to 10◦C.

The PCMC area has invigorating climate throughout the year, it is high altitude, moderate rainfall and a green cover. The monsoon arrives in during first week of July and extends to mid-September. In this period, PCMC witnesses an average annual rainfall is 700-800 mm. The maximum relative humidity during the rainy season is 70-80%, and falls as low as 30% on summer afternoons.

Biodiversity in PCMC

Pimpri Chinchwad city has 164 gardens with a total area of 166.34 ha. The Garden Department of PCMC works towards maintaining and increasing the open and green spaces of the city. The Garden department is also responsible for the plantation on no-development zones. The location, area and quality of green spaces in urban centres influence the quality of urban environment for residents. Urban green spaces are significant for enrichment of biodiversity; these green spaces offer recreational opportunities and contribute to the city aesthetics. Some specialized and popular gardens in the city; such as, Bahinabai Choudhari Zoo, Bird Valley, Rajershi Shahu Udyan, Bhakti Shakti Udyan, Thergaon Boat Club, Bhosari Tourism Centre, Durgadevi Park, Veer Sawarkar Udyan and Nana Nani park are some of the ornamental assets of the city. Some factual collected from the secondary data include:

Table 1: Biodiversity data compiled from primary and secondary assessments

Taxa	Number of Species
Birds	136
Butterflies	50
Freshwater fishes	47
Mammals	6
Trees	184
Shrubs	50
Herbs	182

Exotic species are more as compared to indigenous species in all the gardens. Such tendency may destroy the naturalness of the gardens. A section of local people feel that the idea of landscaping with native plantation should be adopted while enhancing the future green spaces. The canopy of the garden is getting affected by planting exotic species which provide comparatively lesser shade. Use of lawns, in landscaping of gardens, affects the micro-environment of the green spaces as they act as cooling areas that create microhabitat for insects, frogs, toads, lizards and snakes, maintaining food chain. Lack of vegetation cover in cities might be a reason why city is often several degrees hotter than surrounding country sides. Trees can modify micro climatic conditions by their shade. The biodiversity of Bird Valley Park is comparatively good because of the plant diversity, large space with variety of indigenous species; that attract a large number of insects on which insectivorous birds feed. The PCMC Paryavaran Sanskar Udyan in T-Block, MIDC has more natural and native species and has been used as a biodiversity park in Pimpri Chinchwad.

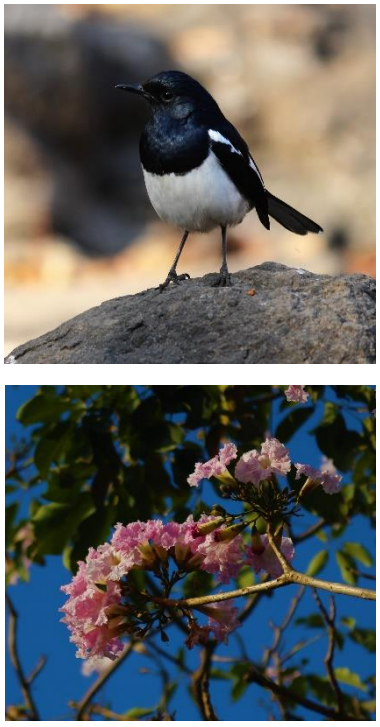

Figure 3: Top - Oriental Magpie Robin in PCMC Science Park; Bottom - Tabebuia rosea in Sant Dyaneshwar Nakshatra Udhyan

Biodiversity Management Committee

In accordance to Biodiversity Act-2000, it is mandatory that PCMC is to constitute a Biodiversity Committee, which will look after overall management of flora and fauna within the Municipal Corporation limit. PCMC has a Biodiversity Management Committee in place. Following are the members of biodiversity management committee of PCMC

SN	Name	Designation
1	Mrs. Usha Ankush Mundhe	Chairperson
2	Mrs. Kamal Anil Gholap	Member
3	Mrs. Archana Tanaji Barne	Member
4	Mrs Suvarna Vikas Burde	Member
5	Mrs Sarika Santosh Landge	Member
6	Mrs Anuradha Ganpat Gorkhe	Member
7	Mrs. Jhamabai Balasaheb Barne	Member
8	Mr. Suresh Salunkhe	Member, Garden Superintendent, PCMC

Figure 4: Bhosari Paryatan Kendra

CBI Calculations

Component 1: Native Biodiversity

Indicator 1: Proportion of Natural Areas

Rationale: Natural ecosystems harbour more species than disturbed or man-made landscapes; hence, higher the percentage of natural areas compared to that of the total city area gives an indication of the biodiversity richness. However, a city by definition has a high proportion of modified land area and therefore this is factored into the scoring.

Taking into account the inherent differences in the richness in biodiversity of tropical versus temperate regions, new versus mature cities, large versus small cities, developing versus developed countries, it was agreed at the Third Expert Workshop on the Development of the City Biodiversity Index that the working definition of "Natural Areas" will be as follows:

'Natural areas comprise predominantly native species and natural ecosystems, which are not, or no longer, or only slightly influenced by human actions, except where such action is intended to conserve, enhance or restore native biodiversity.'

Natural ecosystems are defined as all areas that are natural and not highly disturbed or completely man-made landscapes. Some examples of natural ecosystems are forests, mangroves, freshwater swamps, natural grasslands, streams, lakes, etc. Parks, golf courses, roadside plantings are not considered as natural. However, natural ecosystems with dominant native species within parks can be included in the computation. The definition also takes into consideration "restored ecosystems" and "naturalized areas" in order to recognize efforts made by cities to increase the natural areas of their city. Restoration helps increase natural areas in the city and cities are encouraged to restore their impacted ecosystems.

Scoring Criteria's:

Points	**0 points**	**1 point**	**2 points**	**3 points**	**4 points**
Criteria	< 1.0%	1.0% – 6.9%	7.0% – 13.9%	14.0% – 20.0%	> 20.0%

Results and Calculations:

SN	**Natural Areas**	**Area (ha.)**
1	Natural Water bodies	101.8
2	River	474.1
3	Dense Green Areas	1618.4
4	Natural Grassland	4351.6
5	Open Spaces	201.5
Total of Natural areas		**6747.4**
Total Area of PCMC (Inclusive of Defense Areas)		**22348.56**

$$\frac{Total\ area\ of\ natural\ areas, restored\ and\ naturalized\ areas}{Total\ area\ of\ city} \times \mathbf{100}\ \%$$

== 6747.4 *100 = **30.2%**
22348.56

Score for indicator 1: **4 points**

Comments:

PCMC contains 30.2% of natural areas, hence gets 4 points as a score for this indicator. The city centre of PCMC is highly urbanised with very minimal natural area. The grasslands present at the north eastern side of the city is the major natural area present within Pimpri Chinchwad. Besides this the three rivers viz. Indrayani, Pawana and Mula present in PCMC boundary has been considered as a part of natural areas in Pimpri Chinchwad. The defence areas of CME and Dairy farm present within PCMC has presence of dense green patches of the city. . The naturalised areas viz. the old closed quarries that has now being converted into water bodies are included in this indicator. Refer figure 5 for natural areas within PCMC.

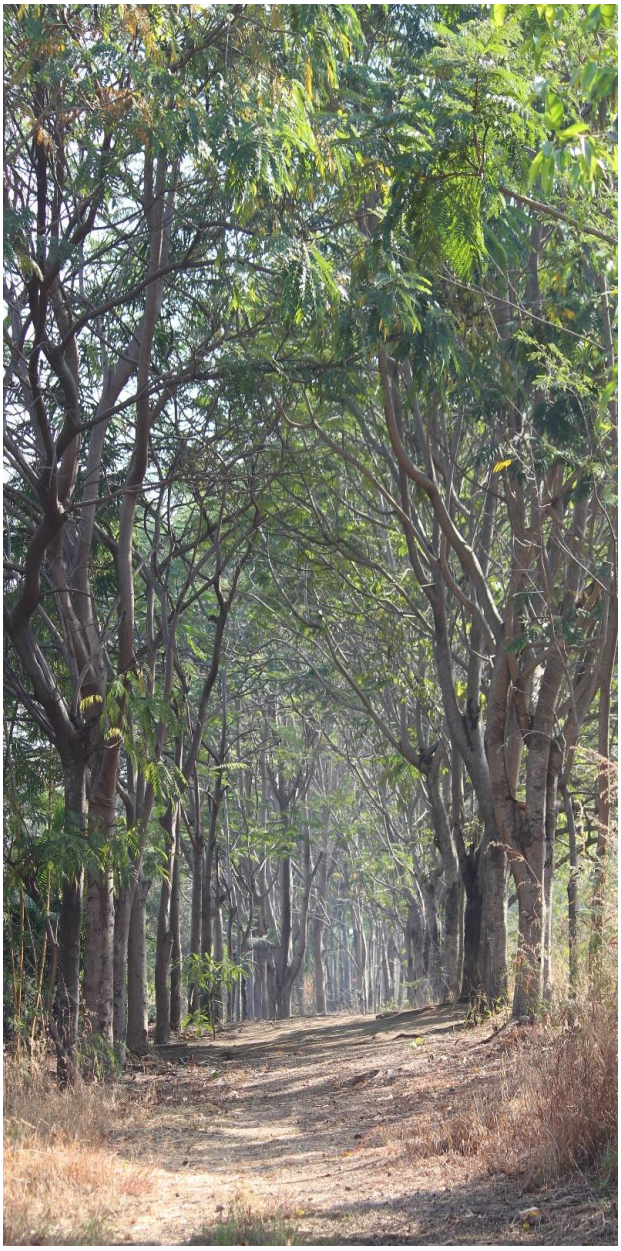

Figure 5: Dense Patch in Tata Motors Limited near Telco Lake

Figure 6: Grassland near Charholi

Figure 7: Pawana River

Figure 8: Water body near Katewasti Forest

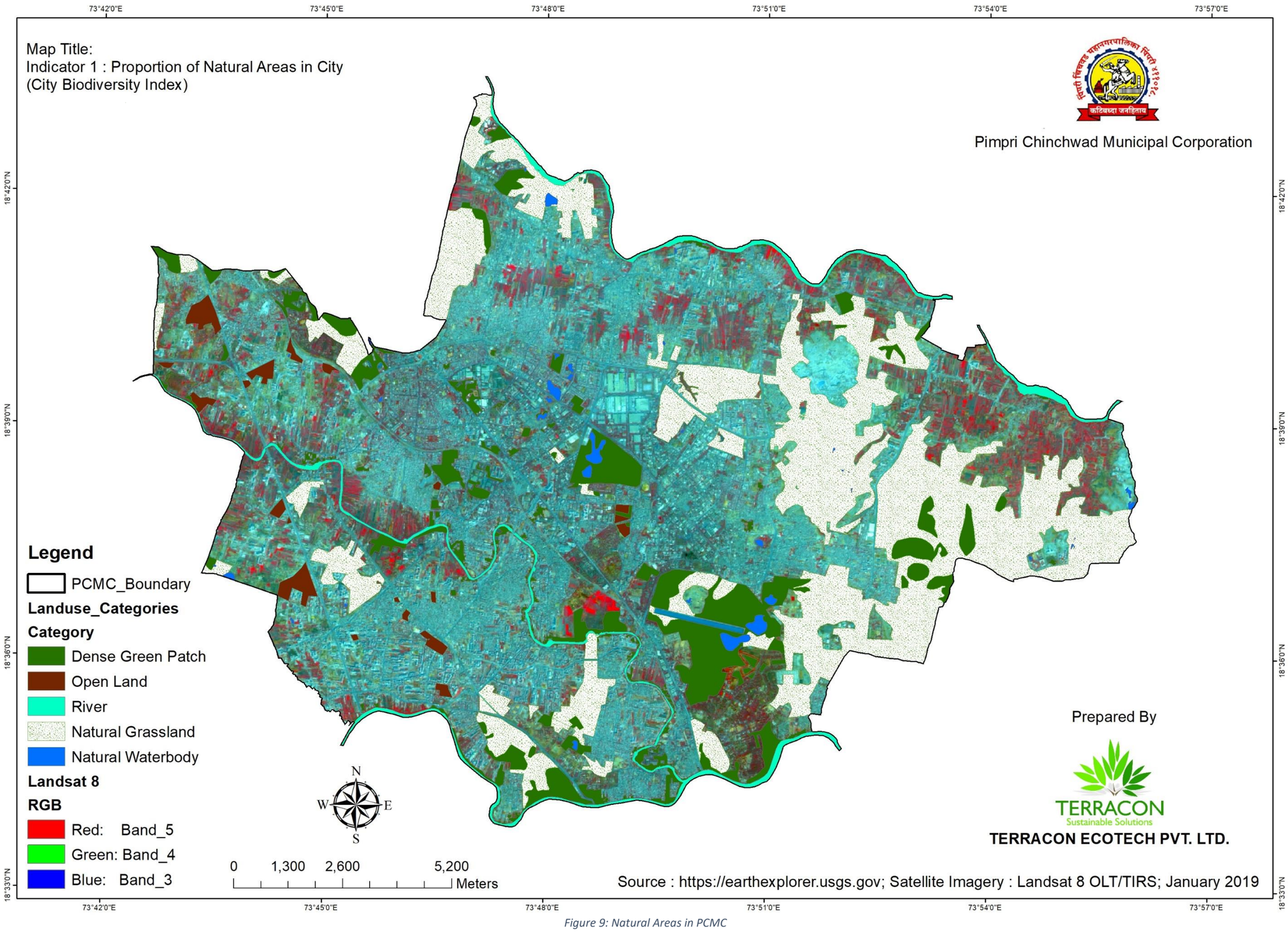

Figure 9: Natural Areas in PCMC

Indicator 2: Connectivity Measures or Ecological Networks to Counter Fragmentation

Rationale: Fragmentation of natural areas is one of the main threats to the sustainability of biodiversity in a city. Hence, it has been selected as an indicator to chart possible future trends. However, it is not easy to measure fragmentation. Some of the ways to measure fragmentation include mean patch size or distance between patches etc.

It is recognized that the fragmentation of natural areas affects different species differently. For example, a road may not be a barrier for birds but it can seriously fragment a population of arboreal primates. A strip of urbanization may not affect the dispersal of wind-pollinated plants but a plant that depends on small mammals for dispersal will be adversely affected. While these differences have been noted, considered and deliberated upon, a pragmatic approach towards the calculation of this indicator is adopted, as reflected in the formula given in the calculation. Furthermore, to encourage positive action to increase connectivity or reduce barriers to connectivity, it would be more meaningful to measure connectivity rather than fragmented plots. This indicator score can be improved when more of the fragments are connected.

Scoring Criteria's:

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

Results:

There are 140 different patches of natural areas that are considered for this indicator. The areas considered in this indicator are agriculture, dense green areas, gardens, grasslands, open patches, river and water bodies. Within these areas there are 84 individual patches where the connectivity is low. The major connectivity patches includes the ones along the rivers in PCMC. Details of the individual areas of different identified patches are given in Annexures 8 and 9.

$(A_1^2 + A_2^2 + A_3^2 + \ldots A_{141}^2) = 9, 21, 10{,}003$

$A_{total} = 10{,}441$

Calculations

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

= 1/10,441* (9, 21, 10,003)

= **8822 ha**

Score for indicator 2: **4 points**

Comments:

This indicator measures effective mesh size of the natural areas in the city. A_1 to A_{141} consists 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. Therefore, larger values of the effective mesh sizes indicate higher connectivity. Pimpri Chinchwad city score **4 point** in this indicator as the connectivity measure of the city **8822 ha** lies in the range of > 1500 ha.

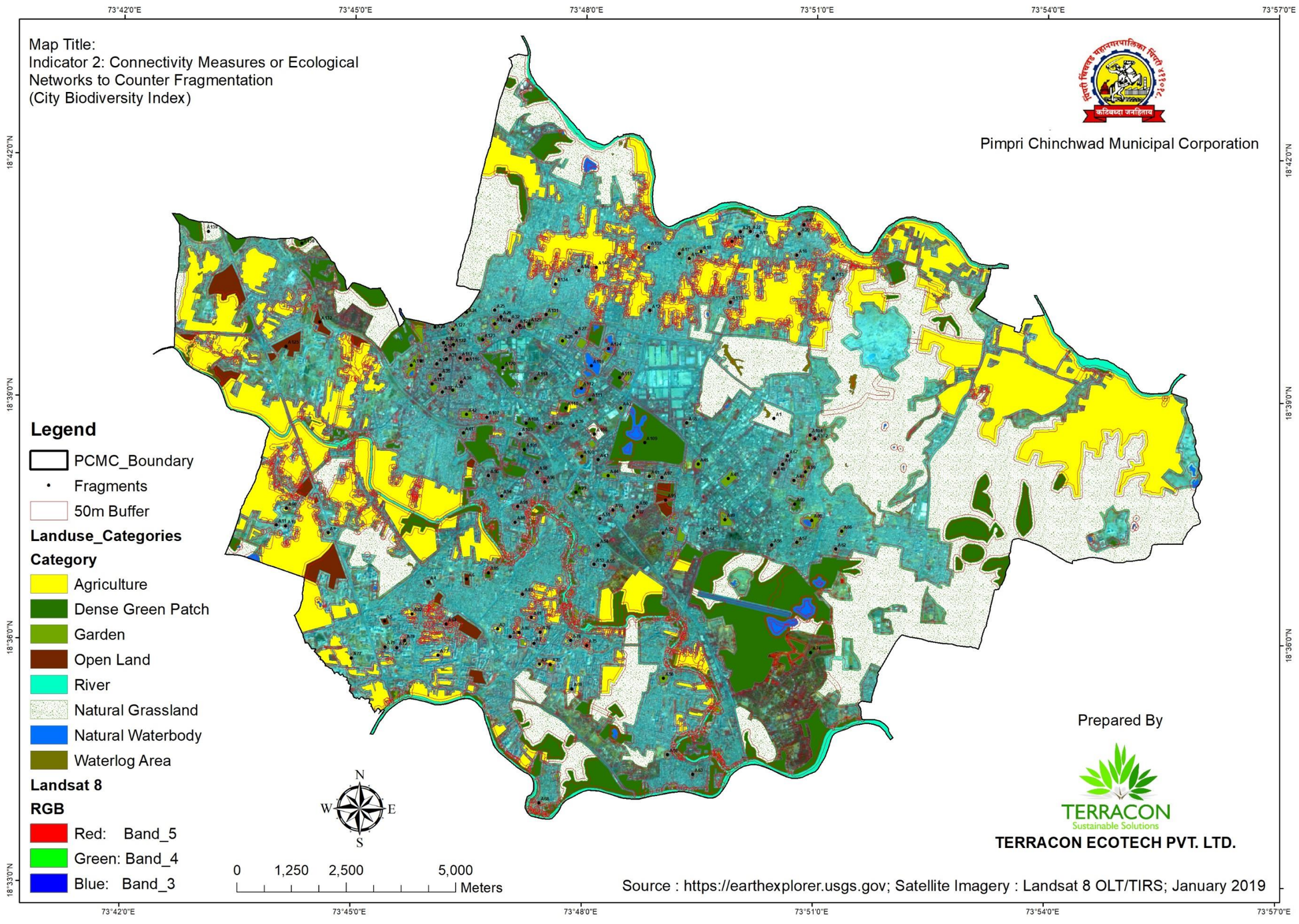

Figure 10: Connectivity measures in PCMC

Indicator 3: Native biodiversity in built-up areas (Bird Species)

Rationale: It is acknowledged that cities comprise largely of built-up areas and brownfield sites with anthropogenic green spaces and minimal natural features. However, it should be recognised that built-up areas and brownfield sites do harbour biodiversity, e.g., birds like swallows and swiftlets nest under roofs of buildings, plants grow on buildings, butterflies flutter around sun-lit shrubs and grassy patches, dragonflies dart above water features, etc. Some built-up areas and brownfield sites have more biodiversity than others. By enhancing certain features in such areas, the biodiversity could improve. Hence, native biodiversity in built-up areas and brownfield sites should be an indicator.

Most cities have data on bird species. Hence, this taxonomic group can be used as an indicator. The number of native bird species in built-up areas and anthropogenic green spaces is inevitably lower than that found in sites with natural ecosystems; however, implementing appropriate measures such as planting fruit trees, shrub with berries, etc. may attract birds into built-up areas of the city.

Figure 11: Crow pheasant near Bhosari

Scoring Criteria's:

0 points: < 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

Results:

Total number of bird species in the built up areas of Pimpri Chinchwad city is **45.** This indicator scores **2 points**. Details of the bird species are given in the Annexure 1.

Comments:

List of birds provided is based on primary survey and literature review. The native bird diversity within the city is good because of the small water bodies present throughout the city and also due to presence of various gardens and parks developed by PCMC. The artificial bird feeders seen in some areas also helps in attracting the birds. The birds like House crow, Rock Pigeon, Common Myna, Oriental Magpie-robin, Purple-rumped sunbirds, Green Bee-eater, Crow Pheasant, Black Kites and Red Vented bulbul were the most commonly seen birds in urban settings of PCMC.

Figure 12: Grey Heron on the built up structure of Bhosari Parvatan Kendra in PCMC

Indicator 4 TO 8: Change in Number of Native Species

Rationale: As CBI is an index focusing on biodiversity in cities, it is essential that the native flora and fauna diversity be incorporated as indicators.
Three key taxonomic groups that are most surveyed worldwide, i.e., plants, birds and butterflies, have been selected as "core indicators". To ensure fairness and objectivity in the index, cities can select 2 other taxonomic groups that would reflect their best biodiversity.
To ensure that these 5 indicators on species are unbiased against any city based on its geographical location, ecological history, size, land-use, etc., it was decided that all cities and local authorities are requested to list the number of native species of a) vascular plants, b) birds, and c) butterflies, d) at least 2 other taxonomic groups, and e) any other taxonomic groups that they have data on.

Scoring Criteria's:

Points	**0 points**	**1 point**	**2 points**	**3 points**	**4 points**
Criteria	maintaining or a decrease in the number of species	1 species increase	2 species increase	3 species increase	4 species or more increase

Indicator 4: Vascular Plants

Total Number of trees in PCMC as per ESR 17 – 18 – **101 species**
The trees present in PCMC – **184 species (Annexure: 2)**
Score – **4 points**

Indicator 5: Birds

Total Number of birds in PCMC as per ESR 16-17 – **33 species**
Total number of bird species in PCMC – **136 species (Annexure: 3)**
Score – **4 points**

Indicator 6: Butterfly

Total Number of butterfly in PCMC as per ESR 17-18 – **32 species**
Total number of butterfly species in PCMC – **50 species (Annexure: 4)**
Score - **4 points**

Indicator 7: Fresh Water Fish

Total Number of butterfly in PCMC as per ESR 16-17 – **5 species**
Total number of freshwater fish species in PCMC – **47 species**
Score - **4 points (Annexure: 5)**

Indicator 8: Mammals

Total number of reptile species in PCMC – **02 species**
Total number of butterfly species in PCMC – **06 species (Annexure: 6)**
Score - **4 points**

Figure 13: Five Striped Palm Squirrel at Veer Savarkar Udyan, PCMC

Comments:

The indicator 4 to 8 does not get scores in the first year of the survey in case of absence of data. However in case of PCMC there is the baseline data for these indicators are documented in the Environment Status Report (ESR) that is published every year. The ESR of the year 2016-17 and 2017-18 has been used as a reference for the baseline data. The data during the current assessment was compiled from primary data at various locations in PCMC and secondary literature survey using portals, records from experts and scientific research documentations. Vascular plants are plants of higher group viz. herbs, shrubs, climbers and trees. Here since the previous data is present only for trees the same is considered for the assessment and the data on herbs and shrubs are provided as an initial baseline data for future assessments. Detailed list of species present in annexures 2,3,4,5,6.

Indicator 9: Proportion of Protected Natural Areas

Rationale: Protected or secured natural areas indicate the city's commitment to biodiversity conservation. Hence, the proportion of protected or secured natural areas is an important indicator. The definition of protected natural areas should be broadened to include legally protected, formally secured areas, and other administratively protected areas, as different cities have different terminologies and means for protecting their natural areas.

Scoring Criteria's:

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

Results:

Score for indicator 9: **0 points**

Comments:

There are no other legally protected natural areas in PCMC.

Indicator 10: Proportion of Invasive Alien Species (as opposed to native species)

Rationale: Invasive alien species out-compete native species and, thus, threaten the survival of native species and the integrity of ecosystems. As cities are very open to influx of alien species, this indicator measures the status of this threat. The definition of alien invasive species adopted follows that accepted by CBD is:

An alien species whose introduction and/ or spread threaten biological diversity (For the purposes of the present guiding principles, the term "invasive alien species" shall be deemed the same as "alien invasive species" (Decision V/8 of the Conference of the Parties to the Convention on Biological Diversity).

Figure 14: Lantana camara - invasive species

It is inevitable in cities, which are open to external influences, to have alien species. Alien species which are not invasive or detrimental to native species are not considered in this indicator. In fact in many cities, exotic or alien species enhance the diversity. Cities can decide on the taxonomic groups which are most problematic for their city or where most data are available.

Scoring Criteria's:

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

Results:

Component	**Number**
Number of invasive plant species in PCMC (Annexure: 7)	24
Number of total native vascular plants	303

Calculations

Number of invasive alien species * 100%
Number of native species
= 24 * 100
302

= **7.9%** of PCMC's flora is invasive alien

Comments:

7.9 % of the vascular flora found in the PCMC city is invasive. *Lantana camara*, *Leucaena leucocephala* and *Gliricidia sepium* are the most common invasive species found in the city. As the proportion of invasive species is more than 1% and less than 11% Pimpri Chinchwad city **scores 3 points** in this indicator.

Figure 15: Patch of Gliricidia sepium at Katevasti forest

Component 2: Ecosystem services provided to the city

Indicator 11: Regulation of Quantity of Water

Rationale: Climate change is in many places predicted to result in increased variability in precipitation which in urban landscapes may translate into high peaks in water-flow and damage to construction, business and transport. Vegetation has a significant effect in reducing the rate of flow of water through the urban landscape, e.g. through presence of forest, parks, lawns, roadside greenery, streams, rivers, water bodies, etc.

Scoring Criteria's:

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

Results:

Component	**Area in Ha.**
Total area of the city	22348.6
Total Terrestrial Area	21738.6
Total permeable area	
Water bodies- ponds, lakes, stream	101.8
River	474.1
Dense Green Patches	1618.4
Park	166.3
Lawns	26.4
Roadside greenery	37.9
Waterlogging	34.0
Natural grassland	4351.5
Agriculture	3568.9
Total	**10379.4**

Total permeable area * 100%
Total area of city

= **10379.4***100%
21738.6
=**47.7%**

Score for indicator 11: **2 points**

Comments:

The permeable areas considered in this indicator include all the natural areas within Pimpri Chinchwad along with Pawana, Indrayani and Mula rivers. PCMC has many agriculture patches near Indrayani and Mula rivers. The areas of agriculture in PCMC along with gardens, lawns and roadside plantations is considered for calculations. The Pimpri Chinchwad is highly urbanised city and the space for permeability of water is less especially at the city centre. PCMC scores 2 points as the total permeable areas in the city is **47.7%.**

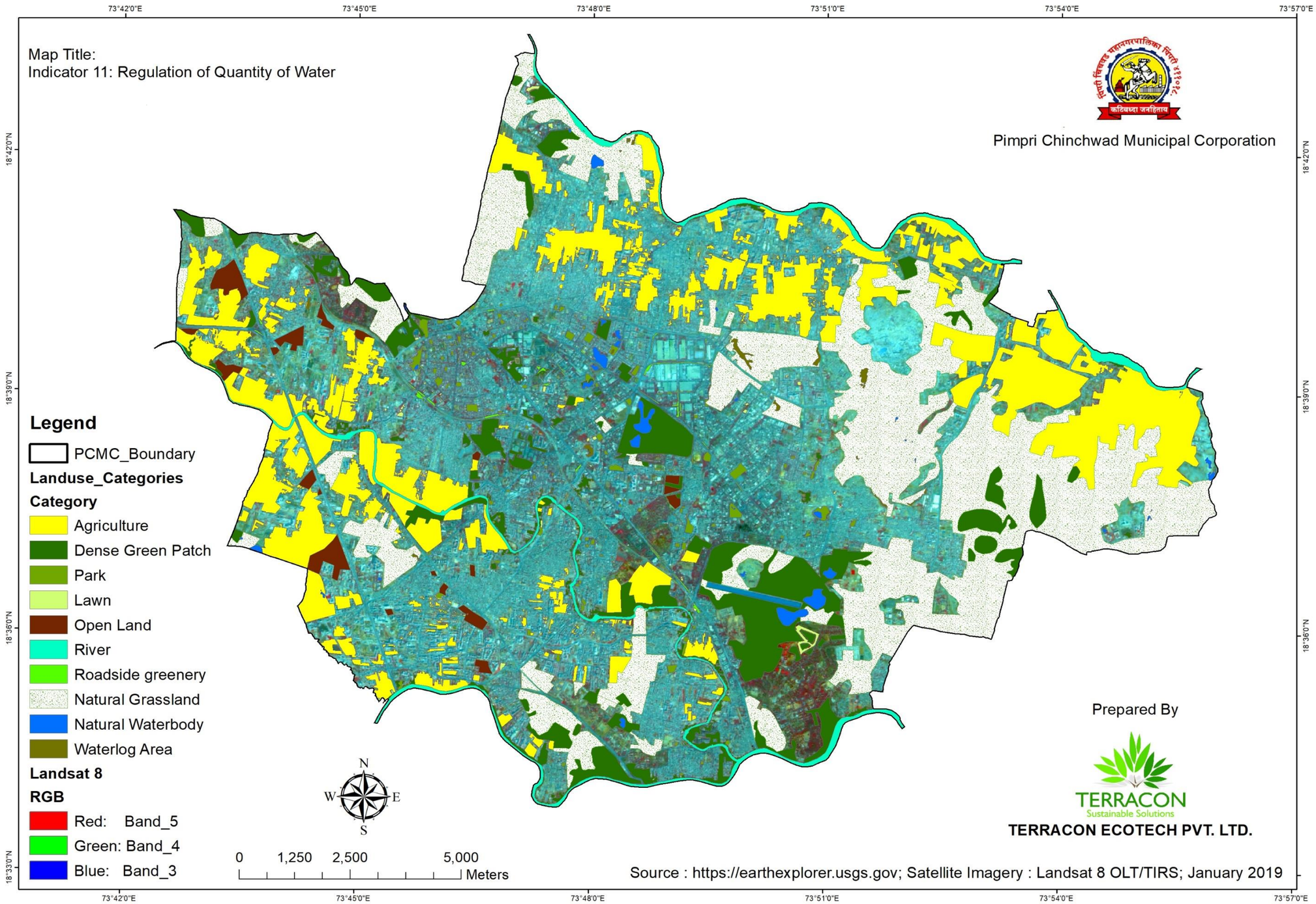

Figure 16: Permeable areas in PCMC

Indicator 12: Climate Regulation: Carbon Storage & Cooling Effect of Vegetation

Rationale: Two important aspects of climate regulation services are carbon storage and cooling effects provided by vegetation, in particular tree canopy cover. Climate regulation services are affected by many factors, including the size of trees, the different characteristics of tree species, and other variables, etc.

With regards to carbon storage, plants capture carbon dioxide during photosynthesis, hence, capturing carbon that is emitted by anthropogenic activities. Canopy cover of trees, which includes those that are naturally occurring and planted in a city, is accepted here as an indirect measure of the carbon sequestration and storage services.

Plants, through shading, evapo-transpiration and decreasing the proportion of reflective surfaces reduce the ambient heat in the air and the surface temperature in the urban landscape. As a general rule, a 10% increase in vegetation cover reduces the temperature by about 3 degrees, hence, cooling the ambient temperatures. The extent of tree canopy cover can also act as a proxy measure for filtering of air and numerous other biodiversity benefits. Planting of native trees to increase the canopy cover is encouraged.

Scoring Criteria's:

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

Results:

Component	Canopy Cover (in ha)
Tree canopy in the city	3856
Terrestrial area of the city	21738.6

$$\frac{\text{Tree canopy cover}}{\text{Total terrestrial area}} \times 100\%$$

$$= \frac{1907.46}{17401.75} \times 100\%$$

= **17.7%**

Score for indicator 12: **1 point**

*The **Normalized Difference Vegetation Index (NDVI)** is an index of plant "greenness" or photosynthetic activity, and is one of the most commonly used vegetation indices. Vegetation indices are based on the observation that different surfaces reflect different types of light differently. It is a numerical indicator that uses the visible and near-infrared bands of the electromagnetic spectrum, and is adopted to analyse remote sensing measurements and assess whether the target being observed contains live green vegetation or not. Generally, healthy vegetation will absorb most of the visible light that falls on it, and reflects a large portion of the near-infrared light. Unhealthy or sparse vegetation reflects more visible light and less near-infrared light. Bare soils on the other hand reflect moderately in both the red and infrared portion of the electromagnetic spectrum. Since the behavior of plants across the electromagnetic spectrum is known, NDVI information can be derived by focusing on the satellite bands that are most sensitive to vegetation information (near-infrared and red). NDVI is calculated on a per-pixel basis as the normalized difference between the red and near infrared bands from an image:*

$$NDVI = \frac{(NIR - RED)}{(NIR + RED)}$$

Where, NIR is the near infrared band value for a cell and RED is the red band value for the cell. The biophysical interpretation of NDVI is the fraction of absorbed photosynthetically active radiation.

Comments:

PCMC has only 17.7% of the tree canopy cover that help in regulation of the climate. The tree canopy cover is more at the city centre where there is urbanization. The outskirts of PCMC has more of a hilly terrain and grassland habitat.

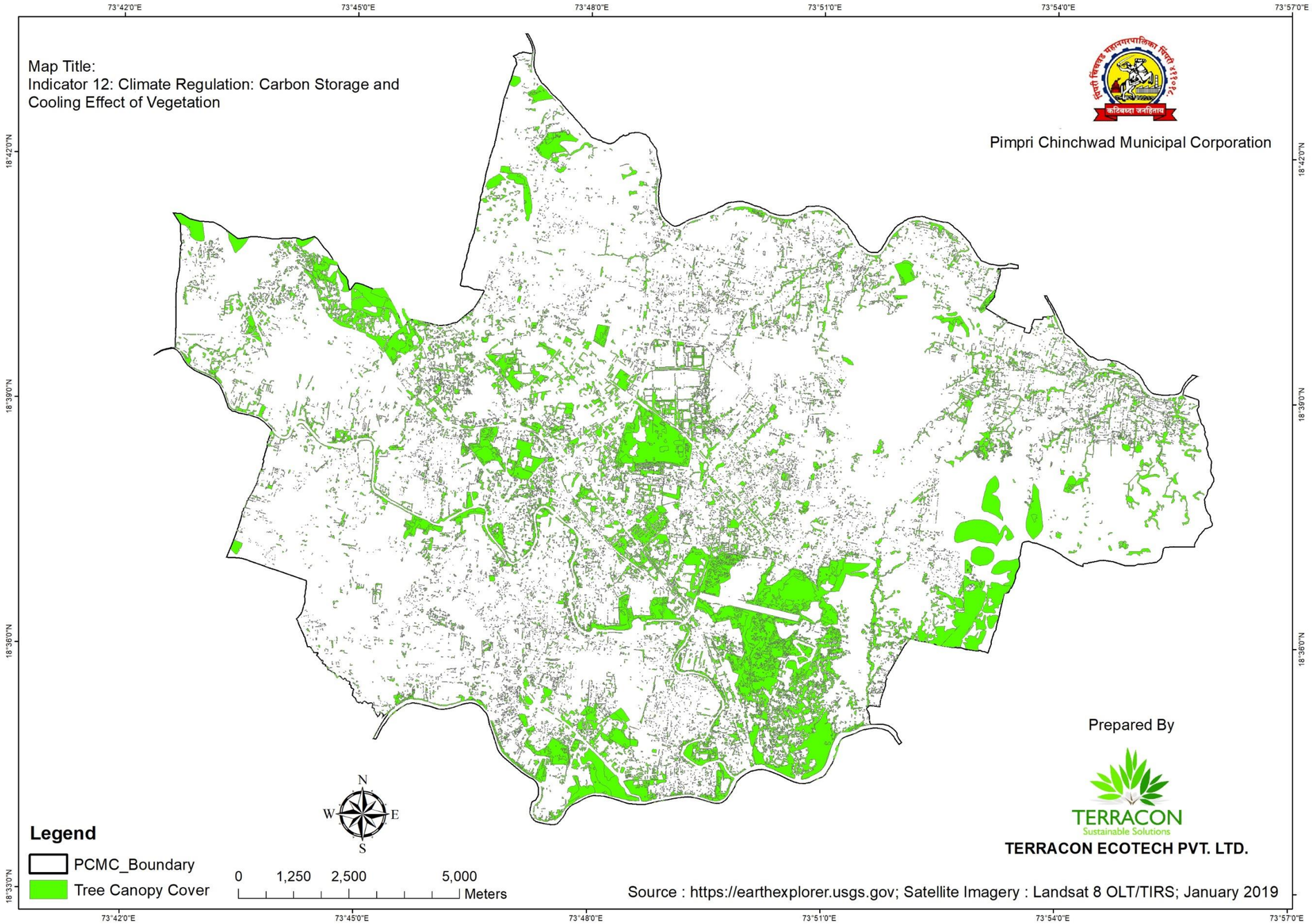

Figure 17: Tree Canopy Cover in PCMC

Indicator 13: Recreational & Educational Services

Rationale: Biodiversity provides invaluable recreational, spiritual, cultural and educational services. It is essential for physical and psychological health. Available recreational and educational places per 1000 persons indicate the availability of ecosystem services to the residents.

Scoring Criteria's:

Points	**0 points**	**1 point**	**2 points**	**3 points**	**4 points**
Criteria	< 0.1 ha/1000 persons	0.1 - 0.3 ha/1000 persons	0.4 - 0.6 ha/1000 persons	0.7 - 0.9 ha/1000 persons	> 0.9 ha/1000 persons

Results:

Places	Area (in ha)
Public Parks	166.34
Water bodies	101.8
River	474.1
Total	742.3

(Area of Parks with natural areas & Protected or secured natural areas)
1000 persons

=742.3/1000
=0.74 ha/1000 person
Score for indicator 13: **3 point**


PCMC THERGAON BOAT CLUB
SUNNY WATER SPORTS CENTRE

Item	Amount	रुपये
Pedal Boat – 2 Seater	Rs.50 per person (20 mins)	५० रुपये प्रत्येक व्यक्ती (२० मिनिटे)
Pedal Boat – 4 Seater	Rs.50 per person (20 mins)	५० रुपये प्रत्येक व्यक्ती (२० मिनिटे)
Motor Boat – 14 Seater	Rs.100 per person (2 kms)	१०० रुपये प्रत्येक व्यक्ती (2 kms)

Please note: Tickets need to be taken for children above 4 years.

Figure 18: Charges at Thergaon Boat Club

Comments:

PCMC has developed around 164 different parks within the city for recreational purpose. The parks such as Durga Devi tekdi, Thergaon Boat Club and Science Park holds a special importance with respect to the recreational and educational activities. Besides these parks the rivers and water bodies are also used by some people for recreational purposes.

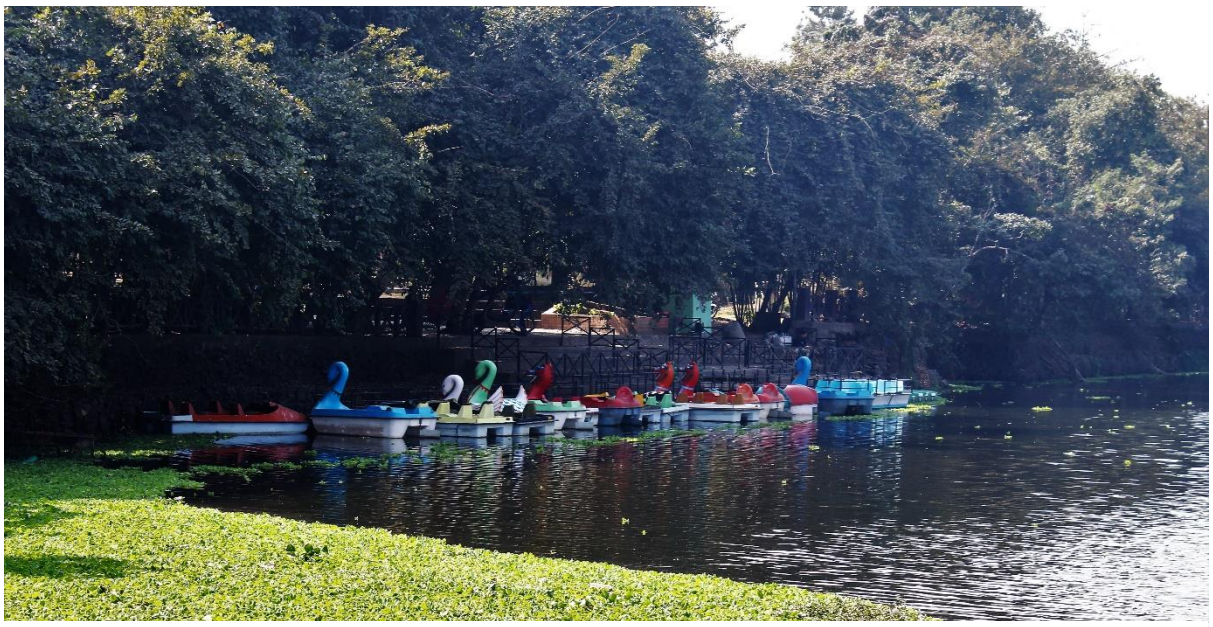

Figure 19: Boating at Thergaon Boat Club

Indicator 14: Number of formal educational visits per child below 16 years to parks with natural areas or protected or secured natural areas per year

Rationale: Nature is a subject that becomes more appealing if it is thought outside the classroom. Formal educational visits from the schools in the city plays a very important role. It is a very effective approach for creating awareness in students about nature.

Scoring Criteria's:

0 points: 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

Results:

1 formal educational visit per year is carried out of the students in the nearby natural recreational areas.

Score for indicator 14: **1 point**

Comments:

The interactions with schools from SSC and CBSC board was conducted for this indicator. The information received during that stated that these schools carry out 1 visit per year. From our interaction with the school teachers we have evaluated that not only more educational trips be organized, proper knowledge about the environment should be imparted during these trips so that the trips are not mere picnics but are educational in nature.

Figure 20: School students visiting PCMC Science Park

Component 3: Governance and Management of Biodiversity

Indicator 15: Budget allocated to biodiversity

Rationale: This indicator evaluates programs and projects that conducted to ensure the maintenance and enhancement of biodiversity in cities.

The relative amount spent on biodiversity related administration by a city can be seen as a representation of the city's commitment towards environmental stewardship. It is recognized that there are numerous other factors affecting the amount allocated towards biodiversity, but in general the greater the proportion of the total city's budget allocated, the greater the level of commitment by the city.

In cities where the functions of maintaining greenery and biodiversity conservation are also assigned to the private sector or government-linked corporations, the budget for these government-linked companies may also be included in the calculations.

Scoring Criteria's:

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

Results:

Amount spent on biodiversity related administration * 100
Total budget of city

=66, 86, 70,400 * 100 = **3.9%**
17,32,82,00,000

Comments:

3.9% of the total annual budget of corporation is reserved for biodiversity related initiatives. Thus, PCMC city scores **4 point** in this indicator.

Indicator 16: Number of Biodiversity Projects Implemented By the City Annually

Rationale:

This indicator measures the number of biodiversity related projects and programmes that the city authorities are involved in, either as the main player or in partnerships with other entities where the city is a key collaborator. Programmes and projects are not limited to the conservation of protected areas but could include those pertaining to species conservation (e.g. plants, birds and butterflies), species recovery, biodiversity surveys, biodiversity enhancement projects, restoration projects, procurement of green services, etc. For a project or a programme to be included in this indicator, biodiversity must be an important consideration in the stated objectives. A programme designed to conserve species that are non-native to the city, but threatened elsewhere (e.g. zoo species conservation projects) can be considered as well.

Scoring Criteria's:

Points	**0 points**	**1 point**	**2 points**	**3 points**	**4 points**
Criteria	< 12 programmes/ projects	12 - 21 programmes/ projects	22 - 39 programmes/ projects	40 - 71 programmes /projects	> 71 programmes/projects

Results:

Programmes/Projects implemented by city	
City Biodiversity Index	People's Biodiversity Register
Local Biodiversity Strategy and Action Plan	Compulsion for GRIHA certification (Green Rating for Integrated Habitat Assessment) for buildings
Tree Census	Urban Forestry Plan
Plantation of Trees	Park Creation
Initiated control over use of pesticides	Vermicomposting
Organic Manure Preparation	Scientific capping of Landfilling
Display Boards of Birds in the city	Save Apta Tree Movement
Celebration of Environment related days/ events	-

Score of indicator 16: **1 point**

Comments:

Since there are only **15 programmes/projects** implemented by PCMC the score for this indicator **is 1 point**

Indicator 17: Policy, rules and regulations – existence of local biodiversity strategy and action plan

Rationale: To ensure that there is good governance, sound policies must be formulated. To facilitate the implementation of biodiversity management policies, rules and regulations must be put in place. This section evaluates the existence of biodiversity-relevant policies, rules and regulations, in particular whether they are aligned with the national agenda and CBD's initiatives, like the National Biodiversity Strategy and Action Plan (NBSAP) and/or the correspondent sub-national strategies.

Some of the CBD initiatives include plant conservation, forest biodiversity, global taxonomy initiative, invasive species program, marine biodiversity conservation, protected areas, etc.

The initiatives might not be termed LBSAP. As long as the city can justify that a similar plan exists

Scoring Criteria's:

0 points: 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

Results:

Currently Pimpri Chinchwad Municipal Corporation does not have a Local Biodiversity Strategy and Action Plan or similar plan. Hence, PCMC will get a score **0 points** in this indicator

Comments:

Pimpri Chinchwad Municipal Corporation has initiated the process of preparation of LBSAP for conservation of biodiversity and ecosystem services within the city.

Indicator 18: Number of essential biodiversity-related functions that the city uses

Rationale: Institutions are necessary for the effective implementation of projects and programs. Hence, the existence of biodiversity-focussed and biodiversity-related institutions will greatly enhance biodiversity conservation in a city.

Some of the essential institutions include a well-managed biodiversity centre, herbarium, zoological garden or museum, botanical garden, insectariums, etc. It is more important to measure whether the functions of these institutions exist rather than the physical existence of these institutions. Hence, if a herbarium is situated in a botanical garden, then two functions exist in the city under one institution.

Scoring Criteria's:

Points	**0 points**	**1 point**	**2 points**	**3 points**	**4 points**
Criteria	No functions	1 function	2 functions	3 functions	*> 3 function*

Results:

The following places that occur within Pimpri Chinchwad city limits are open to visitors:

1. Bahinibai Choudhary Garden – Zoological Park
2. Durga Devi Garden - Floral recreational garden and Bird boards
3. Yashwantrao Chavan Gulab Pushpa Garden - Rose Park
4. Sant Dnyaneshwar Nakshatra Garden - Medicinal Plants garden
5. Pariyavaran Sanskar Kendra (T-Block MIDC)- Biodiversity garden
6. Janseva Ayurvedik Vanaushadhi Udhyan – Medicinal garden
7. Science Park – Documentary on Biodiversity

Score for indicator 18: **4 points**

Comments:

Since Pimpri Chinchwad has more than 3 biodiversity related functions the city scores 4 points in this indicator.

Figure 21: 3D hall for documentary at PCMC Science Park

Indicator 19: Number of city or local government agencies involved in inter-agency co-operation pertaining to biodiversity matters

Rationale: Many biodiversity issues are cross-sectorial and, hence, involve inter-agency efforts. The evaluation of inter-agency coordination is an important indicator of the success of biodiversity conservation, more so in a city where it is so compact. This indicator promotes mainstreaming of biodiversity.

Scoring Criteria's:

0 points: one or two agencies cooperate on biodiversity matters
1 point: three agencies cooperate on biodiversity matters
2 points: four agencies cooperate on biodiversity matters
3 points: five agencies cooperate on biodiversity matters
4 points: More than five agencies cooperate on biodiversity matters

Results:

3 city or local government agencies cooperate on biodiversity matters with PCMC
Score for indicator 19: **1 point**

Comments:

PCMC works in close association Maharashtra State Biodiversity Board and has formed Biodiversity Management Committee for conservation. PCMC also works in association with State Forest Department for plantation related works. PCMC is in regular consultation with Centre for Environment Education (CEE)

Indicator 20: Existence and state of formal or informal public consultation process pertaining to biodiversity-related matters

Rationale: This indicator evaluates the existence and the state of formal or informal public consultation process pertaining to biodiversity-related matters

Figure 22: Stakeholder Consultation meeting regarding biodiversity of PCMC

Scoring Criteria's:

0 points: 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

Results:

There is an informal public consultation process pertaining to biodiversity-related matters with the local subject experts and organisations and NGO's. The same is being considered as a part of routine process. Therefore, Pimpri Chinchwad city scores **1 point** in this indicator.

Indicator 21: Number of agencies / private companies /NGOs /academic institutions /international organizations with which the city is partnering in biodiversity activities, projects and programs

Rationale: This indicator measures the extent of informal and/or formal partnerships, or collaboration with other entities. As it is impossible for any single agency to carry out all the activities, responsibilities, projects and programs that have biodiversity implications, hence, it is inevitable that engagement of all levels of the population must be facilitated. These include the city officials in various departments, other spheres of government, the public, private sector, NGOs, etc. Such partnerships should have substantial and long-term involvement on the part of the city officials

Scoring Criteria's:

0 points: No formal or informal partnerships

1 point: City in partnership with 1-6 other national or sub-national agencies/private companies /NGOs /academic institutions/international organisations

2 points: City in partnership with 7-12 other national or sub-national agencies/private companies /NGOs/academic institutions/international organisations

3 points: City in partnership with 13-19 other national or sub-national agencies/private companies /NGOs/academic institutions/international organisations

4 points: City in partnership with 20 or more other national or sub-national agencies/private companies /NGOs/academic institutions/international organisations

Results:

Name of the Organizations/NGO/Private companies/Institutions PCMC has partnered for Biodiversity	
Jaldindi Prathisthan	Paryavaran Sanvardhan Samiti
NGO – Alive	SanakarPrathisthan
Garahak Manch	Devrai Foundation plant research
Samyak Drishti Foundation - Save Apta Tree	Mahindra Vehicle Manufacturing Ltd
WILO Mather & Platt Pumps Pvt. Ltd	Kala group of Industries
Quik Heal foundation	Roshani
JSPMS college of Pharmacy	Modern High school English Medium
Terracon Ecotech Private Limited	Mantras Green Resources Ltd
Ultra-Tech Environmental Consultancy and Laboratory	

PCMC has partnered with **17** private companies/NGOs /academic institutions/international organisations for biodiversity related program or projects

Score of PCMC for Indicator 21: **3 Point**

Comments:

PCMC is involved with many of these organizations mainly related to tree plantations and awareness programmes. PCMC is conducting various activity viz. Tree Inventorization, Urban Tree Management Plan, People's Biodiversity Register and Local Biodiversity Strategy and Action Plan with Terracon Ecotech Private limited. Also, the Environment Status Report of PCMC that included biodiversity component is prepared by Mantras Green Resources Ltd and Ultra-Tech Environmental Consultancy and Laboratory.

Indicator 22: Is biodiversity or nature awareness included in the school curriculum

Rationale: Education can be divided into two categories, formal through the school curriculum or informal. Two aspects will be evaluated, i.e., formal education and public awareness. While Indicator 14 gives an indication of school children's use of recreational services provided by ecosystems, Indicators 22 and 23 highlight:
(i) Whether biodiversity is included in the school curriculum; and
(ii) The number of outreach or public awareness events which are held per year

Most cities have no jurisdiction over school curricular. The incorporation of this indicator creates the opportunity for city officials to liaise with education officers so that biodiversity courses are taught at pre-school, primary, secondary and tertiary levels.

Scoring Criteria's:

0 points: 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

Results:

Biodiversity or elements of it (environment sciences) are included in the school curriculum. Environmental awareness is a compulsory subject in all schools; therefore PCMC city gets **4 points**

Indicator 23: Number of outreach or public awareness events held in the city per year

Rationale: For this indicator, the event should either be organised entirely by the city authorities, or there should be substantial involvement of the authorities before the event can be considered for inclusion in the indicator. Events that just take place within the city are not considered, as they are not representative of the governance exerted by the city authorities.

Scoring Criteria's:

0 points: 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

Results:

5 outreach programmes are conducted by PCMC.
Score for indicator 23: **1 point**

Comments:

PCMC is involved in outreach programmes viz. Rainbow BRTS Promotion and Outreach Program, Science shows involving biodiversity in Science Park and Eco-friendly Ganesh idol making workshop. Educational visits are being are being considered in Janseva Ayurvedik Vanaushadhi Udhyan. Tree plantation activity has been conducted on regular basis by PCMC.

Summary of the Scores

Component	Indicator Number	Indicator Name	Results	Score Obtained	Max Score
Native Biodiversity	Indicator 1	Proportion of natural areas	PCMC contains **30.2%** of natural areas	**4**	**4**
	Indicator 2	Connectivity measures	The connectivity measure of the city **8822 ha**	**4**	**4**
	Indicator 3	Native biodiversity (birds in built up area)	Total number of bird species in the built up areas of Pimpri Chinchwad city is **45.**	**2**	**4**
	Indicator 4	Number of vascular plant	Total Number of trees in PCMC as per ESR 17 – 18 – **101 species** The trees present in PCMC – **185 species**	**4**	**4**
	Indicator 5	Birds	Total Number of birds in PCMC as per ESR 16-17 – **33 species** Total number of bird species in PCMC – **136 species**	**4**	**4**
	Indicator 6	Butterflies	Total Number of butterfly in PCMC as per ESR 17-18 – **32 species** Total number of butterfly species in PCMC – **50 species**	**4**	**4**
	Indicator 7	Taxa of Choice (Fresh water Fishes)	Total Number of butterfly in PCMC as per ESR 16-17 – **5 species** Total number of freshwater fish species in PCMC – **47 species**	**4**	**4**
	Indicator 8	Taxa of Choice (Mammals)	Total number of reptile species in PCMC – **02 species** Total number of butterfly species in PCMC – **06 species**	**4**	**4**
	Indicator 9	Proportion of protected area	PCMC has no legally protected areas	**0**	**4**
	Indicator 10	Proportion of invasive alien species	**7.9%** invasive floral species present	**3**	**4**
Ecosystem Service provided by biodiversity	Indicator 11	Regulation of quantity of water	The total permeable area in the city is only **47.7%.**	**2**	**4**
	Indicator 12	Carbon storage and cooling effect	PCMC has only **17.7%** of the tree canopy cover	**1**	**4**
	Indicator 13	Area of parks and gardens	**0.74 ha/1000 person**	**3**	**4**
	Indicator 14	Number of formal educational visits to natural area	**1** formal educational visit per year	**1**	**4**

Component	Indicator Number	Indicator Name	Results	Score Obtained	Max Score
Governance and Management of Biodiversity	Indicator 15	Budget allocated to biodiversity	**3.9%** of budget is spent on biodiversity	**4**	**4**
	Indicator 16	Number of biodiversity project implemented by city /year	**15 programmes/projects**	**1**	**4**
	Indicator 17	Existence of LBSAP	**No existing LBSAP**	**0**	**4**
	Indicator 18	Number of biodiversity related functions	**7 biodiversity related functions**	**4**	**4**
	Indicator 19	Number of cities/local governments involved pertaining to biodiversity matter	**3 city or local government agencies cooperate on biodiversity matters**	**1**	**4**
	Indicator 20	Existence and state of formal or informal public consultation process pertaining to biodiversity related matters.	**There is an informal public consultation process pertaining to biodiversity-related matters with the local subject experts and organisations and NGO's. The same is being considered as a part of routine process.**	**0**	**4**
	Indicator 21	Number of organizations with which the city is partnering in biodiversity activities, projects and programs.	**PCMC has partnered with 17 private companies/NGOs /academic institutions/international organisations for biodiversity related program or projects**	**3**	**4**
	Indicator 22	Is biodiversity or nature awareness included in the school curriculum	**Biodiversity or elements of it (environment sciences) are included in the school curriculum.**	**4**	**4**
	Indicator 23	Number of outreach or public awareness events held in the city per year.	**5 outreach programmes**	**1**	**4**
			Native Biodiversity in the City (Sub-total for indicators 1-10)	**33**	**40**
			Ecosystem Services provided by Biodiversity (Sub-total for indicators 11-14)	**7**	**16**
			Governance and Management of Biodiversity (Sub-total for indicators 15-23)	**18**	**36**
			Maximum Total	**58**	**92**

Annexures

Annexure 1. List of Birds in Built Up area in PCMC

No.	Common Name	Scientific Name	Family	IUCN status	WPA Status	CITES Appendix
1	Ashy Prinia	*Prinia socialis*	Cisticolidae	LC	-	-
2	Asian Koel	*Eudynamys scolopaceus*	Cuculidae	LC	-	-
3	Black Drongo	*Dicrurus macrocercus*	Dicruridae	LC	IV	-
4	Black Kite	*Milvus migrans*	Accipitridae	LC	-	II
5	Brahminy Starling	*Sturnia pagodarum*	Sturnidae	LC	IV	-
6	Cattle Egret	*Bubulcus ibis*	Ardeidae	LC	IV	-
7	Cinereous Tit	*Parus cinereus*	Paridae	-	IV	-
8	Citrine Wagtail	*Motacilla citreola*	Motacillidae	LC	-	-
9	Common Kingfisher	*Alcedo atthis*	Alcedinidae	LC	IV	-
10	Common Myna	*Acridotheres tristis*	Sturnidae	LC	IV	-
11	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	LC	IV	-
12	Common Tailorbird	*Orthotomus sutorius*	Sylviidae	LC	-	-
13	Coppersmith Barbet	*Psilopogon haemacephalus*	Megalaimidae	LC	IV	-
14	Eurasian Hobby	*Falco subbuteo*	Falconidae	LC	IV	II
15	Greater Coucal	*Centropus sinensis*	Cuculidae	LC	-	-
16	Green Bee-eater	*Merops orientalis*	Meropidae	LC	-	-
17	Grey Wagtail	*Motacilla cinerea*	Motacillidae	LC	-	-
18	House Crow	*Corvus splendens*	Corvidae	LC	V	-
19	House Sparrow	*Passer domesticus*	Passeridae	LC	-	-
20	Indian Golden Oriole	*Oriolus kundoo*	Oriolidae	LC	IV	-
21	Indian Pond Heron	*Ardeola grayii*	Ardeidae	LC	-	-
22	Indian Robin	*Saxicoloides fulicatus*	Motacillidae	LC	-	-
23	Large-billed Crow (Jungle Crow)	*Corvus macrorhynchos*	Corvidae	LC	-	-

No.	Common Name	Scientific Name	Family	IUCN status	WPA Status	CITES Appendix
24	Large Grey Babbler	*Turdoides malcolmi*	Leiothrichidae	LC	IV	-
25	Little Egret	*Egretta garzetta*	Ardeidae	LC	-	-
26	Little Swift	*Apus affinis*	Apodidae	LC	-	-
27	Oriental Magpie-robin	*Copsychus saularis*	Muscicapidae	LC	-	-
28	Oriental White-eye	*Zosterops palpebrosus*	Zosteropidae	LC	-	-
29	Paddyfield Pipit	*Anthus rufulus*	Motacillidae	LC	-	-
30	Purple Sunbird	*Cinnyris asiaticus*	Nectariniidae	LC	IV	-
31	Purple-rumped Sunbird	*Nectarinia zeylonica*	Nectariniidae	LC	IV	-
32	Red-naped Ibis	*Pseudibis papillosa*	Threskiornithidae	LC	IV	-
33	Red-vented Bulbul	*Pycnonotus cafer*	Pycnonotidae	LC	-	-
34	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	LC	-	-
35	Red-whiskered Bulbul	*Pycnonotus jocosus*	Pycnonotidae	LC	IV	-
36	Blue Rock Pigeon	*Columba livia*	Columbidae	LC	-	-
37	Rose-ringed Parakeet	*Psittacula krameri*	Psittacidae	LC	IV	NC
38	Tickell's Blue Flycatcher	*Cyornis tickelliae*	Muscicapidae	LC	IV	-
39	Yellow Wagtail	*Motacilla flava*	Motacillidae	LC	-	-
40	White Wagtail	*Motacilla alba*	Motacillidae	LC	-	-
41	White-breasted Kingfisher	*Halcyon smyrnensis*	Alcedinidae	LC	IV	-
42	White-eyed Buzzard	*Butastur teesa*	Accipitridae	LC	-	II
43	White-breasted Kingfisher	*Halcyon smyrnensis*	Alcedinidae	LC	IV	-
44	Wire-tailed Swallow	*Hirundo smithii*	Hirundinidae	LC	-	-
45	Woolly-necked Stork	*Ciconia episcopus*	Ciconiidae	VU	IV	-

LC= Least Concern, VU= Vulnerable (Source: Primary Survey)

Annexure 2: List of Flora/Vascular Plants in PCMC

SN	Scientific Name	Common name(English)	Local name(Marathi)	Family	Habitat	Origin	IUCN status
Trees							
1	*Acacia auriculiformis* Benth.	Ear-leaf Acacia	Australian Acacia	Mimosaceae	Evergreen	E	LC
2	*Acacia chundra* (Rottler) Willd.	Cutch Tree	Kattha	Mimosaceae	Deciduous	N	NA
3	*Acacia mangium*Willd.	Black wattle	-	Mimosaceae	Evergreen	E	NA
4	*Acacia planifrons* Wight & Arn.	Umbrella Thorn	Chatri-babhul	Mimosaceae	Deciduous	N	NA
5	*Acacia leucophloea* (Roxb.) Willd.	White barked Acacia	Safed Babul	Mimosaceae	Evergreen	E	NA
6	*Acacia nilotica* (L.) Delile	Gum Arabic	Babul	Mimosaceae	Evergreen	E	LC
7	*Adansonia digitata* L	Baobab	Gorakhchich	Bombacaceae	Deciduous	E	NA
8	*Aegle marmelos* (L.) Corrêa	Stone Apple	Maredu	Rutaceae	Deciduous	N	NA
9	*Ailanthus excelsa* Roxb.	Indian Tree of Heaven	Mahavruksh	Simaroubaceae	Deciduous	N	NA
10	*Albizia lebbeck* (L.) Benth.	Siris tree	Shirish	Mimosaceae	Perennial	N	NA
11	*Albizia procera* Roxb.	White Shirish	Kinhai	Mimosaceae	Perennial	N	NA
12	*Albizia amara* (Roxb.) B.Boivin	Krishna Siris	Krishna Shirish	Mimosaceae	Deciduous	N	NA
13	*Albizia saman* (Jacq.) Merr	Rain tree	-	Mimosaceae	Deciduous	E	NA
14	*Alstonia macrophylla* Wall. ex G.Don	Devil tree	Mothi Satvin	Apocynaceae	Evergreen	E	NA
15	*Alstonia scholaris* (L.) R. Br.	Scholar tree	Satvin	Apocynaceae	Evergreen	N	LC
16	*Anacardium occidentale* L.	Cashew	Kaju	Anacardiaceae	Evergreen	E	NA
17	*Annona reticulata* L.	Netted Custard Apple	Ramphal	Annonaceae	Deciduous	E	NA
18	*Annona squamosa* L.	Sugar Apple	Sitaphal	Annonaceae	Perennial	E	NA
19	*Anogeissus latifolia* (Roxb. ex DC.) Wall. ex Bedd.	Axle wood tree	Dhawada	Combretaceae	Deciduous	N	NA
20	*Anthocephalus cadamba* (Roxb.) Miq.	Kadam	Kadamb	Rubiaceae	Perennial	N	NA
21	*Aphanamixis polystachya* (Wall.) R.Parker	Pithraj tree	Raktharohida	Meliaceae	Deciduous	N	NA
22	*Araucaria columnaris* (G.Forst.) Hook.	-	Christmas tree	Araucariaceae	Evergreen	E	NA
23	*Areca catechu* L.	Betel Palm	Supari	Arecaceae	Evergreen	N	NA

SN	Scientific Name	Common name(English)	Local name(Marathi)	Family	Habitat	Origin	IUCN status
24	*Artocarpus heterophyllus* Lam.	Jackfruit	Phanas	Moraceae	Evergreen	N	NA
25	*Azadirachta indica A.* Juss.	Neem	Kadulimb	Meliaceae	Evergreen	N	LC
26	*Bauhinia purpurea* L	Purple Orchid Tree	Raktchanadan	Caesalpiniaceae	Deciduous	N	NA
27	*Bauhinia racemosa* Lam.	Bidi leaf tree	Apta	Caesalpiniaceae	Deciduous	N	NA
28	*Bauhinia semla* Wunderlin	Roxburgh's Bauhinia	Semla Kanchan	Caesalpiniaceae	Deciduous	N	NA
29	*Bauhinia tomentosa* L.	Yellow Orchid Tree	Pivala Kanchan	Caesalpiniaceae	Perennial	E	NA
30	*Bauhinia variegata* L.	Variagated Bahunia	Kanchan	Caesalpiniaceae	Deciduous	N	LC
31	*Betula utilis* D.Don	Himalayan Birch	Bhor Patra	Betulaceae	Deciduous	N	LC
32	*Bombax ceiba* L.	Silk Cotton Tree	Katesavar	Bombacaceae	Deciduous	N	NA
33	*Borassus flabellifer* L.	Toddy palm	Taad	Arecaceae	Evergreen	E	NA
34	*Buchanania cochinchinensis* (Lour.) M.R.Almeida	Chironji Tree	Charoli	Anacardiaceae	Deciduous	N	NA
35	*Butea monosperma* (Lank.) Taub.	Flame of forest	Palas	Fabaceae	Deciduous	N	NA
36	*Callistemon citrinus* (Curtis)Skeels	Crimson bottlebrush	-	Myrtaceae	Evergreen	E	NA
37	*Callistemon lanceolatus*(Sm.)Sweet	Red bottle brush	-	Myrtaceae	Evergreen	E	NA
38	*Callistemon viminalis* (Sol. ex Gaertn.) G.Don	Weeping Bottle brush tree	-	Myrtaceae	Evergreen	E	NA
39	*Callistemon salignus* (Sm.) Colv. ex Sweet	White bottle brush	-	Myrtaceae	Evergreen	E	NA
40	*Capparis grandis* L.f.	Tree Caper	Pachunda	Capparidaceae	Perennial	N	NA
41	*Careya arborea* Roxb. i	Wild Guava	Kumbha	Lecythidaceae	Deciduous	N	NA
42	*Caryota urens* L.	Fish tail Palm	Bherli Mad	Arecaceae	Evergreen	N	NA
43	*Cascabela thevetia* (L.) Lippold.	Mexican oleander	Pivali Kanher	Apocynaceae	Evergreen	E	NA
44	*Cassia fistula* L.	Golden shower tree	Bahava	Caesalpiniaceae	Deciduous	N	NA
45	*Cassia javanica* L.	Java Cassia	-	Caesalpiniaceae	Deciduous	E	NA
46	*Cassia siamea* lan	-	Kassod	Caesalpiniaceae	Evergreen	N	NA
47	*Cassine glauca* (Rottb.) Kuntze	Ceylon Tea	Bhutya	Celastraceae	Evergreen	N	NA

SN	Scientific Name	Common name(English)	Local name(Marathi)	Family	Habitat	Origin	IUCN status
48	*Casuarina equisetifolia* forst.	Whistling Pine	Suru	Casuarinaceae	Perennial	E	NA
49	*Ceiba pentandra* (L.) Gaertn.	White Silk-Cotton Tree	Sawar	Malvaceae	Deciduous	E	NA
50	*Citrus aurantiifolia* (Christm.) Swingle	Sour Lime	Limbu	Rutaceae	Evergreen	N	NA
51	*Cochlospermum religiosum* (L.) Alston	Buttercup tree	Ganeri	Bixaceae	Deciduous	N	NA
52	*Cocus nucifera* L.	Coconut	Naral	Arecaceae	Evergreen	N	NA
53	*Cordia dichotoma* G.Forst.	Indian Cherry	Bhokar	Boraginaceae	Deciduous	N	NA
54	*Cordia sinensis* Lam.	-	Gondhan	Boraginaceae	Perennial	N	NA
55	*Cordia sebestena* L.	-	Scarlet Cordia	Boraginaceae	Evergreen	E	NA
56	*Crataeva nurvala* Buch.-Ham.	Caper tree	Varuna	Capparaceae	Deciduous	N	NA
57	*Crescentia cujete* L.	Calabash tree	Vadga	Bignoniaceae	Evergreen	E	NA
58	*Dalbergia latifolia* Roxb	Black rosewood	Shisam	Fabaceae	Deciduous	N	VU
59	*Dalbergia sisoo* Roxb.	Indian rosewood	Shisam	Fabaceae	Perennial	N	NA
60	*Dalbergia lanceolaria* var. *lanceolaria*	Takoli	Dandus	Fabaceae	Perennial	N	NA
61	*Dalbergia lanceolaria* var. *paniculata*	-	Phanshi	Fabaceae	Perennial	N	NA
62	*Delonix regia* (Hook.) Raf.	Flame tree	Gulmohar	Caesalpiniaceae	Evergreen	E	LC
63	*Desmodium oojeinense* (Roxb.) H.Ohashi	Sandan	Kalapalas	Fabaceae	Deciduous	N	NA
64	*Dichrostachys cinerea* (L.) Wight & Arn.	Sickle Bush	Kunali	Mimosaceae	Deciduous	N	LC
65	*Dillenia indica L.*	Elephant Apple	Karmal	Dilleniaceae	Deciduous	N	NA
66	*Diospyros malabarica* (Desr.) Kostel.	Indian persimmon	Temru	Ebenaceae	Evergreen	N	NA
67	*Drypetes roxburghii* (Wall.) Hurus.	Lucky bean tree	Putranjiva	Putranjivaceae	Evergreen	N	NA
68	*Erythrina variegata* L.	Indian Coral Tree	Pangara	Fabaceae	Deciduous	N	NA
69	*Eucalyptus globulus* Labill.	Southern blue-gum	Nilgiri	Myrtaceae	Evergreen	E	NA
70	*Euphorbia neriifolia* L.	Indian Spurge Tree	Nevagunda	Euphorbiaceae	Perennial	N	NA
71	*Ficus amplissima* Sm.	Bat tree	Paypar	Moraceae	Evergreen	N	NA
72	*Ficus arnottiana* (Miq.) Miq.	Indian Rock Fig	Payar	Moraceae	Evergreen	N	NA
73	*Ficus benghalensis* L.	Banyan	Vad	Moraceae	Evergreen	N	NA

SN	Scientific Name	Common name(English)	Local name(Marathi)	Family	Habitat	Origin	IUCN status
74	*Ficus benjamina* L.	Weeping Fig	Nandruk	Moraceae	Evergreen	N	NA
75	*Ficus elastica* Roxb. ex Hornem.	Indian Rubber tree	Rubberacho vad	Moraceae	Evergreen	N	NA
76	*Ficus exasperata* Vahl	Brahma's Banyan	Kharoti	Moraceae	Deciduous	N	NA
77	*Ficus hispida* L.f.	Hairy Fig	Kala Umber	Moraceae	Deciduous	N	NA
78	*Ficus krishnae* C.DC.	Krishna Fig	Krishnvad	Moraceae	Evergreen	N	NA
79	*Ficus microcarpa* L.f.	Laurel Fig	Nandruk	Moraceae	Evergreen	N	NA
80	*Ficus racemosa* L	Cluster Fig	Umber	Moraceae	Evergreen	N	NA
81	*Ficus religiosa* L.	Sacred Fig tree	Pimpal	Moraceae	Evergreen	N	NA
82	*Ficus tsiela* Roxb.	Soft Fig	Pimpran	Moraceae	Perennial	N	NA
83	*Ficus carica* L.	Common Fig	Anjir	Moraceae	Deciduous	N	NA
84	*Flacourtia indica* (Burm.f.)Merr	Governor's Plum	Bilangada	Saliaceae	Deciduous	N	NA
85	*Gliricidia sepium* (Jacq.) Kunth.ex.steud	Mexican Iiac	Saranga	Fabaceae	Deciduous	E	NA
86	*Gmelina arborea* Roxb	Gamhar	Sivan	Lamiaceae	Deciduous	N	NA
87	*Grevillea robusta* Cunn. ex R. Br.	Silver Oak	-	Proteaceae	Evergreen	E	NA
88	*Grewia asiatica* L.	Phalsa	Phalsi	Tiliaceae	Perennial	N	NA
89	*Grewia serrulata* DC.	Serrulate-Leaf Grewia	Dhamni	Tiliaceae	Evergreen	N	NA
90	*Grewia tiliifolia* Vahl	-	Dhaman	Malvaceae	Perennial	N	NA
91	*Haldina cordifolia* (Roxb.)Ridsdale	-	Haldu	Rubiaceae	Deciduous	N	NA
92	*Hardwickia binata* Roxb.	-	Anjan	Caesalpiniaceae	Deciduous	N	NA
93	*Helicteres isora* L.	East-Indian Screw Tree	Murud sheng	Malvaceae	Deciduous	N	NA
94	*Heterophragma quadriloculare* (Roxb.) K.Schum.	Waras	Waras	Bignoniaceae	Deciduous	N	NA
95	*Holarrhena pubescens* Wall. ex G.Don	Indrajao	Indrajav	Apocynaceae	Deciduous	N	NA
96	*Holoptelea integrifolia* Planch.	Jungle cork tree	Wavhal	Ulmaceae	Deciduous	N	NA
97	*Jacaranda mimosifolia* D.Don	Blue Jacaranda	Neela gulmohar	Bignoniaceae	Deciduous	E	NA
98	*Khaya grandifoliola* C.DC	-	Mahogany	Meliaceae	Evergreen	E	NA

SN	Scientific Name	Common name(English)	Local name(Marathi)	Family	Habitat	Origin	IUCN status
99	*Khaya senegalensis* (Desv.) A.Juss.	African Mahogany	Khaya	Meliaceae	Deciduous	E	NA
100	*Kigelia africana* (Lam.) Benth.	-	Sausage tree	Bignoniaceae	Deciduous	E	NA
101	*Lagerstroemia speciosa* (L.) Pers.	Queen Crape Myrtle	Tamhan	Lythraceae	Evergreen	N	NA
102	*Lannea coromandelica* (Houtt.)Merr.	Indian ash tree	Shemat	Anacardiaceae	Deciduous	N	NA
103	*Leucaena leucocephala* (Lam.) de Wit	Wild Tamrind	Subabhool	Mimosaceae	Evergreen	E	NA
104	*Limonia acidissima* Groff	Wood Apple	Kavath	Rutaceae	Deciduous	N	NA
105	*Madhuca longifolia* (J.Koenig ex L.) J.F.Macbr.	Indian butter tree	Mahua	Sapotaceae	Deciduous	N	NA
106	*Magnolia champaca* (L.) Baill. ex Pierre	Golden Champa	Pivala chafa	Magnoliaceae	Evergreen	N	NA
107	*Mangifera indica* L.	Mango	Amba	Anacardiaceae	Evergreen	N	DD
108	*Manilkara hexandra* (Roxb.) Dubard	Ceylon Iron Wood	Khirni	Sapotaceae	Evergreen	N	NA
109	*Manilkara zapota* (L.) P.Royen	Sapota	Chiku	Sapotaceae	Perennial	E	NA
110	*Markhamia lutea* (Benth.) K.Schum.	-	Markhamia	Bignoniaceae	Perennial	E	NA
111	*Melaleuca bracteata* F.Muell.	Golden bottle brush	-	Myrtaceae	Evergreen	E	NA
112	*Melia azedarach* L.	Chinaberry tree	BakNimb	Meliaceae	Evergreen	N	NA
113	*Melia dubia*Cav.	Malabar Neem	Mahanimb	Meliaceae	Deciduous	N	NA
114	*Memecylon umbellatum* Burm. f.	Ironwood Tree	Anjani	Melastomataceae	Perennial	N	NA
115	*Mesua ferrea* L.	Indian rose chestnut	Nagkesar	Calophyllaceae	Evergreen	N	NA
116	*Millingtonia hortensis* L.f.	Indian cork tree	Kaval nimb	Bignoniaceae	Deciduous	N	NA
117	*Mimusops elengi* L	Spanish cherry	Bakuli	Sapotaceae	Perennial	N	NA
118	*Mitragyna parvifolia* (Roxb.) Korth.	True Kadamb	Kalamb	Rubiaceae	Deciduous	N	NA
119	*Morinda citrifolia* L.	Indian Mulberry	Tuti	Rubiaceae	Perennial	E	NA
120	*Moringa oleifera* Lam	Drumstick Tree	Shevga	Moringaceae	Deciduous	N	NA
121	*Morus alba* L.	White Mulberrry	Tuti	Moraceae	Perennial	N	NA
122	*Muntingia calabura* L.	Jamaica Cherry	Paanchara	Muntingiaceae	Evergreen	E	NA

SN	Scientific Name	Common name(English)	Local name(Marathi)	Family	Habitat	Origin	IUCN status
123	*Murraya koenigii* (L.) Spreng	Curry leaf	Kadhipatta	Rutaceae	Evergreen	N	NA
124	*Murraya paniculata* (L.) Jack	Orange Jasmine	Kamini	Rutaceae	Evergreen	N	NA
125	*Neolamarckia cadamba* (Roxb.) Bosser	-	Kadamb	Rubiaceae	Perennial	N	NA
126	*Nyctanthes arbor-tristis* L.	Coral Jasmine	Parijatak	Oleaceae	Evergreen	N	NA
127	*Oroxylum indicum* (L.) Kurz	Broken Bones Tree	Tivas	Bignoniaceae	Deciduous	N	NA
128	*Parkia biglandulosa* Wight & Arn.	Badminton Ball tree	Chenduphul	Mimosaceae	Deciduous	E	NA
129	*Parkia biglobosa* (Jacq.) G.Don	African locust bean	Kalapalas	Mimosaceae	Deciduous	E	NA
130	*Peltophorum pterocarpum* (Dc.) Baker	Copperpod	Pivla gulmohar	Caesalpiniaceae	Evergreen	E	NA
131	*Phoenix canariensis* Chabaud	Canary date palm	-	Arecaceae	Evergreen	E	LC
132	*Phoenix sylvestris* (L.) Roxb.	Wild Date Palm	Shindi	Arecaceae	Evergreen	N	NA
133	*Phyllanthus acidus* (L.) Skeels	Star Gooseberry	Rai-awla	Phyllanthaceae	Deciduous	N	NA
134	*Phyllanthus emblica* L.	Indian gooseberry	Awala	Phyllanthaceae	Deciduous	N	NA
135	*Pithecellobium dulce* (Roxb.) Benth.	Madras Thorn	Vilayatichinch	Mimosaceae	Perennial	E	NA
136	*Platycladus orientalis* (L.) Franco	Oriental Arborvitae	Mayurpankhi	Cupressaceae	Perennial	E	NA
137	*Plumeria alba* L.	White Frangipani	Pandhara Chafa	Apocynaceae	Evergreen	E	NA
138	*Plumeria rubra* L.	Red Fragipani	Lal chapha	Apocynaceae	Deciduous	E	NA
139	*Polyalthia longifolia* (Sonner.) Thw.	False Ashok	Asupalav	Annonaceae	Evergreen	N	NA
140	*Pongamia pinnata* (L.) Pierre	Pongam tree	Karanj	Fabaceae	Deciduous	N	NA
141	*Populus nigra* L.	Black Poplar	-	Salicaceae	Deciduous	E	NA
142	*Prosopis cineraria* (L.) Druce	Khejari	Shami	Mimosaceae	Deciduous	N	NA
143	*Prosopis juliflora* (Sw.) DC.	Algaroba	Vedi-babhul	Mimosaceae	Deciduous	E	NA
144	*Psidium guajava* L.	Common guava	Peru	Myrtaceae	Evergreen	E	NA
145	*Pterocarpus santalinus* L.f.	Red sandalwood	Raktchanadan	Fabaceae	Deciduous	N	NT
146	*Pterocarpus marsupium* Roxb.	Indian Kino Tree	Bibla	Fabaceae	Deciduous	N	NA
147	*Pterospermum acerifolium* (L.) Willd.	Maple-leaved Bayur tree	Karnikar	Sterculiaceae	Perennial	N	NA

SN	Scientific Name	Common name(English)	Local name(Marathi)	Family	Habitat	Origin	IUCN status
148	*Pterygota alata* (Roxb.) R.Br.	Buddha Coconut	-	Malvaceae	Evergreen	N	NA
149	*Punica granatum* L.	Pomegranate	Dalimb	Lythraceae	Perennial	N	NA
150	*Putranjiva roxburghii* Wall.	-	Putranjiva	Putranjivaceae	Evergreen	N	NA
151	*Riccinus communis* L.	Castor bean	Erandi	Euphorbiaceae	Perennial	N	NA
152	*Roystonea regia* (H.B.&K)	Royal Palm	-	Arecaceae	Perennial	E	NA
153	*Salix tetrasperma* Roxb.	Indian willow	Valunj	Salicaceae	Deciduous	N	NA
154	*Santalum album* L.	Indian Sandalwood	Chandan	Santalaceae	Evergreen	N	VU
155	*Sapindus trifoliatus* L.	South India Soapnut	Rithi	Sapindaceae	Deciduous	N	NA
156	*Saraca indica* L.	Ashok	Sita Ashok	Caesalpiniaceae	Evergreen	N	VU
157	*Schefflera actinophylla* (Endl.) Harms	Queensland Umbrella tree	-	Araliaceae	Evergreen	E	NA
158	*Schrebera swietenioides* Roxb.	Weaver's Beam Tree	Murwa	Oleaceae	Deciduous	N	NA
159	*Semecarpus anacardium* L.f.	Marking Nut	Bibba	Anacardiaceae	Deciduous	N	NA
160	*Senegalia catechu* (L. f.) P.J.H. Hurter & Mabb.	Cutch tree	Khair	Mimosaceae	Deciduous	N	NA
161	*Senna siamea* (Lam.) H.S.Irwin & Barneby	Siamese Senna	Kassod	Fabaceae	Evergreen	N	NA
162	*Spathodea campanulata* beauv	African Tulip tree	Rugtoora	Bignoniaceae	Evergreen	E	NA
163	*Sterculia foetida* L.	Java Olive	Jungli Badam	Sterculiaceae	Evergreen	N	NA
164	*Sterculia urens* Roxb.	Gum karaya	Sardol	Sterculiaceae	Deciduous	N	NA
165	*Stereospermum chelonoides* (L.f.) DC.	Fragrant Padri Tree	Padal	Bignoniaceae	Deciduous	N	NA
166	*Swietenia macrophylla* King	Big leaf mahogany	-	Meliaceae	Deciduous	E	VU
167	*Swietenia mahagoni* (L.) Jacq.	-	Mahogany	Meliaceae	Evergreen	E	NA
168	*Syzigium cumuni* (L.) Skeels	Indian black berry	Jambhul	Myrtaceae	Evergreen	N	NA
169	*Syzygium jambos* (L.) Alston	Rose Apple	Jamb	Myrtaceae	Evergreen	N	NA
170	*Tabebuia argentea* Britt.	Pink trumpet tree	-	Bignoniaceae	Deciduous	E	NA
171	*Tabebuia aurea* (Silva Manso) Benth. & Hook.f. ex S.Moore	Caribbean Trumpet Tree	-	Bignoniaceae	Evergreen	E	NA

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172	*Tabebuia heterophylla* (DC.) Britton, 1915	Cuban Pink Trumpet Tree	-	Bignoniaceae	Deciduous	E	NA
173	*Tamarindus indica* L.	Tamarind	Chinch	Caesalpiniaceae	Deciduous	E	LC
174	*Tecoma stans* (L.) Juss. ex Kunth	Yellow bells	Ghanti ful	Bignoniaceae	Perennial	E	NA
175	*Tectona grandis* L.F.	Teak	Sag	Lamiaceae	Perennial	N	NA
176	*Terminalia alata* Roth	Indian Laurel	Ain	Combretaceae	Perennial	N	NA
177	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	Arjun	Arjun	Combretaceae	Evergreen	N	NA
178	*Terminalia bellirica* (Gaertn.) Roxb.	Bedda nut tree	Behda	Combretaceae	Deciduous	N	NA
179	*Terminalia catappa* L.	Indian Almond	Jungli Badam	Combretaceae	Deciduous	N	NA
180	*Terminalia mantaly* H. Perrier	-	Madagascar almond	Combretaceae	Evergreen	E	NA
181	*Thespesia populnea* (L.)Sol. Ex Correa	Indian tulip tree	Paras Bhendi	Malvaceae	Evergreen	N	NA
182	*Wodyetia bifurcata* A.K.Irvine	Fox-tail palm	-	Arecaceae	Evergreen	N	NA
183	*Ziziphus jujuba* Mill.	Indian plum	Bordi	Rhamnaceae	Deciduous	N	LC
184	*Ziziphus mauritiana* Lam.	Indian Plum	Ber	Rhamnaceae	Deciduous	N	NA
Shrubs and Climbers							
185	*Abutilon indicum* (L.) Sweet	Indian Mallow	Petari	Malvaceae	Perennial	N	NA
186	*Argyreia nervosa* (Burm. f.) Bojer	Elephant Creeper	Gugguli	Convolvulaceae	Perennial	N	NA
187	*Asparagus racemosus* Willd.	Buttermilk root	Shatavari	Asparagaceae	Perennial	N	NA
188	*Bambusa arundinacea* (Retz.) Willd	Indian Thorny Bamboo	Maanga	Poaceae	Perennial	N	NA
189	*Bambusa vulgaris* Sch.	-	Bamboo	Poaceae	Perennial	N	NA
190	*Barleria prionitis* L.	Porcupine Flower	Pila piyabansa	Acanthaceae	Perennial	N	NA
191	*Bougainvillea spectabilis* Willd.	Great Bougainvillea	Boganvel	Nyctaginaceae	Perennial	E	NA
192	*Caesalpinia pulcherrima* (L.) Sw	Peacock flower	Sankasur	Caesalpiniaceae	Perennial	N	NA
193	*Calotropis gigantea* (L.) Dryand.	Crown flower	-	Apocynaceae	Evergreen	N	NA
194	*Calotropis procera* (Ait.)R. Br.	-	Mandara	Apocynaceae	Evergreen	N	NA

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195	*Carissa carandas* L.	-	Karanda	Apocynaceae	Perennial	N	NA
196	*Clitoria ternatea* L.	Butterfly Pea	Gokurna	Fabaceae	Perennial	E	NA
197	*Cocculus hirsutus* L.	Broom creeper	Vasanvel	Menispermaceae	Perennial	N	NA
198	*Cryptolepis dubia* (Burm.f.)M.R.Almeida	Wax Leaved Climber	-	Apocynaceae	Perennial	N	NA
199	*Cryptostegia grandiflora* Roxb. ex R.Br.	Rubber vine	Vilyati-Vakundi	Apocynaceae	Perennial	E	NA
200	*Dregea volubilis* (L.f.) Benth. ex Hook.f.	Sneeze Wort	Harandodi	Apocynaceae	Perennial	N	NA
201	*Euphorbia lactea* Haw.	Candelabra Spurge	-	Euphorbiaceae	Perennial	N	NA
202	*Euphorbia royleana* Boiss.	Danda Thor	Pivala Dudhi	Euphorbiaceae	Perennial	N	NA
203	*Euphorbia tirucalli* L.	Pencil tree	Sher-kandvel	Euphorbiaceae	Perennial	E	NA
204	*Gymnosporia senegalensis* (Lam.) Loes.	Red spike Thorn	Henkal	Celastraceae	Perennial	N	NA
205	*Hibiscus rosasinensis* L.	Chinese rose	Jaswand	Malvaceae	Perennial	N	NA
206	*Hygrophila auriculata* (Schumach.) Heine	Long leaved barleria	Marsh Barbel	Acanthaceae	Perennial	N	LC
207	*Indigofera cassioides* DC.	Cassia Indigo	Baroli	Fabaceae	Perennial	N	NA
208	*Ipomoea cairica* (L.)Sweet.	Hairy woodrose	-	Convolvulaceae	Perennial	N	NA
209	*Ipomoea carnea* Jacq.	Bush Morning Glory	Besharam	Convolvulaceae	Perennial	E	NA
210	*Ipomoea eriocarpa* R.Br.	Tiny morning glory	-	Convolvulaceae	Perennial	N	NA
211	*Ipomoea hederifolia* L.	Scarlet Morning Glory	Lal pungli	Convolvulaceae	Perennial	E	NA
212	*Ipomoea nil* (L.) Roth	Blue Morning Glory	Neelpushpi	Convolvulaceae	Annual	N	NA
213	*Ixora coccinea* L.	Ixora red	-	Rubiaceae	Perennial	N	NA
214	*Jacquemontia pentantha* (Jacq.) G. Don	Skyblue Clustervine	-	Convolvulaceae	Perennial	E	NA
215	*Justicia quinqueangularis* K.D.Koenig ex Roxb.	Water-willow	-	Acanthaceae	Evergreen	N	LC
216	*Lantana camara* L.	West Indian Lantana	Ghaneri	Verbinaceae	Perennial	E	NA
217	*Lawsonia inermis* L.	Henna	Mehendi	Lythraceae	Deciduous	N	NA
218	*Malachra capitata* (L.) L.	-	Brazil Jute	Malvaceae	Annual	E	NA
219	*Mimosa hamata* Willd.	Hooked Mimosa	Gulabi Babhul	Mimosaceae	Perennial	N	NA

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220	*Nerium oleander* L.	Oleander	Kaner	Apocynaceae	Evergreen	N	NA
221	*Opuntia elatior* Mill.	Prickly Pear	Nivdung	Cactaceae	Perennial	E	NA
222	*Parthenium hysterophorus* L.	Carrot Grass	Gajar Gavat	Asteraceae	Annual	E	NA
223	*Senna alata* (L.) Roxb	Candle bush	-	Caesalpiniaceae	Perennial	N	NA
224	*Senna alexandrina* Mill.	Sonamukhi	-	Caesalpiniaceae	Perennial	N	NA
225	*Senna auriculata* (L.) Roxb.	Tanner's Cassia	Tarwad	Caesalpiniaceae	Perennial	N	NA
226	*Senna sulfurea* (Collad.)	Sulphur Cassia	Motha Tarvad	Caesalpiniaceae	Perennial	N	NA
227	*Senna tora* (L.) Roxb.	Stinking Cassia	Takla	Caesalpiniaceae	Perennial	N	NA
228	*Thunbergia alata* Boj. Ex Sims.	Black eyed susan vine	-	Acanthaceae	Annual	E	NA
229	*Tinospora cordifolia* (Willd.) Miers	Indian Tinospora	Gulvel	Menispermaceae	Perennial	N	NA
230	*Tridax procumbens* (L.) L.	Tridax Daisy	Dagadipala	Asteraceae	Annual	E	NA
231	*Triumfetta rhomboidea* Jacq.	Burr Bush	Jhinjhardi	Malvaceae	Perennial	N	NA
232	*Vigna sublobata* (Roxb.) Babu and Sharma	Wild Mung bean	Ran-udid	Fabaceae	Annual	N	NA
233	*Ziziphus xylopyrus* (Retz.) Willd.	Jackal Jujube	Burgi	Rhamnaceae	Perennial	N	NA
234	*Ziziphus oenopolia* (L.) Mill.	Wild Jujube	Burgi	Rhamnaceae	Perennial	N	NA
Herbs							
235	*Acanthospermum hispidum* DC.	Bristly starbur	-	Asteraceae	Annual	N	NA
236	*Achyranthes aspera* L.	Pricky chaff flower	Aghada	Amaranthaceae	Perennial	N	NA
237	*Acmella paniculata* (Wall. ex DC.) R.K.Jansen	Panicled Spot Flower	-	Asteraceae	Annual	N	LC
238	*Aeschynomene indica* L.	Indian Joint Vetch	Nalabi	Fabaceae	Perennial	E	NA
239	*Agave americana* L.	Century plant	Kamal cactus	Asparagaceae	Perennial	E	NA
240	*Ageratum conyzoides* (L.) L	Goat weed	Ghanera osaadi	Asteraceae	Annual	E	NA
241	*Aloe vera* (L.) Burm.f.	Burn plant	Korphad	Asphodelaceae	Perennial	E	NA
242	*Alternanthera bettzickiana* (Regel) G.Nicholson	Calico Plant	-	Amaranthaceae	Perennial	E	NA
243	*Alternanthera paronychioides* A.St.-Hil.	Smooth chaff flower	-	Amaranthaceae	Perennial	E	NA

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244	*Alternanthera philoxeroides* (Mart.) Griseb.	Alligator Weed	-	Amaranthaceae	Perennial	E	NA
245	*Alternanthera pungens* Kunth	Khaki Weed	Chibuk Kata	Amaranthaceae	Perennial	E	NA
246	*Alternanthera sessilis* (L.) R.Br. ex DC.	Sessile Joyweed	Kanchari	Amaranthaceae	Perennial	N	LC
247	*Alysicarpus longifolius* (Spreng.) Wigt & Arn.	Jangali gailia	Shevra	Fabaceae	Annual	N	NA
248	*Alysicarpus pubescens* J. S. Law	Bicolor Alyce Clover	Durangi shevra	Fabaceae	Annual	N	NA
249	*Alysicarpus tetragonolobus* Edgew.	Red Alyce Clover	Lal Shevra	Fabaceae	Annual	N	NA
250	*Amaranthus roxburghianus* H.W.Kung	Amaro	-	Amaranthaceae	Annual	N	NA
251	*Amaranthus spinosus* L.	Pricky amaranth	Katemath	Amaranthaceae	Annual	N	NA
252	*Amaranthus tricolor* L.	Edible amaranth	Chavalaayi	Amaranthaceae	Annual	N	NA
253	*Amaranthus viridis* L.	Pigweed	Math	Amaranthaceae	Annual	N	NA
254	*Ammannia baccifera* L.	Blistering Ammannia	Bhar Jambhal	Lythraceae	Annual	N	NA
255	*Ammannia multiflora* Roxb.	Many Flowered Ammannia	-	Lythraceae	Perennial	N	NA
256	*Apluda mutica* L.	Mauritian Grass	Bhongla	Poaceae	Perennial	N	NA
257	*Argemone mexicana* L.	Mexican Prickly Poppy	Firangi dhotra	Papaveraceae	Annual	E	NA
258	*Bacopa monnieri* (L.) Pennell	Indian pennywort	Bhrami	Plantaginaceae	Perennial	N	NA
259	*Bergia ammannioides* Roxb.	Ammannia Waterwort	-	Elatinaceae	Annual	N	NA
260	*Bidens bipinnata* L.	Spanish needles	-	Asteraceae	Annual	E	NA
261	*Bidens biternata* (Lour.) Merr. & Sherff	Yellow Flowered Blackjack	-	Asteraceae	Annual	N	NA
262	*Blumea lacera* (Burm.f.) DC.	-	Bhamurda	Asteraceae	Annual	N	NA
263	*Boerhavia repens* L	Spiderlings	Punarnava	Nyctaginaceae	Perennial	N	NA
264	*Brassica juncea* (L.) Czern. & Coss	Indian mustard	Rai	Brassicaceae	Annual	N	NA
265	*Buchnera hispida* Buch.-Ham. ex D.Don	Hairy Buchnera	Karanji	Orobanchaceae	Annual	N	NA
266	*Caesulia axillaris* Roxb.	Pink Node Flower	Maka	Asteraceae	Annual	N	NA
267	*Canscora diffusa* (Vahl) R.Br. ex Roem. & Schult	Kilwar	Kilwar	Gentianaceae	Annual	N	NA

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268	*Caralluma adscendens* var. *fimbriata* (Wall.) Gravely & Mayur.	Caralluma	Makadshing	Apocynaceae	Perennial	N	NA
269	*Catharanthus roseus* (L.) G.Don	Rosy periwinkle	Sadafuli	Apocynaceae	Evergreen	E	NA
270	*Celosia argentea* L.	Cockscomb plumed	Kurdu	Amaranthaceae	Annual	N	NA
271	*Celosia spicata* Spreng.	Silver cockscomb	-	Amaranthaceae	Annual	E	NA
272	*Centaurium pulchellum* (Sw.) Druce	Pink Centaury	Luntak	Gentianaceae	Annual	N	LC
273	*Chloris barbata* Sw.	Swollen fingergrass	-	Poaceae	Annual	N	NA
274	*Chloris virgata* Sw.	Swollen Finger Grass	Gondvel	Poaceae	Annual	N	NA
275	*Chromolaena odorata* (L.) R.M.King & H.Rob.	Siam Weed	Ran-mari	Asteraceae	Perennial	E	NA
276	*Chrozophora rottleri* (Geiseler) A.Juss. ex Spreng	Suryavarti	Survarli	Euphorbiaceae	Perennial	N	NA
277	*Cleome felina* L.f	Cat Spider Flower	-	Cleomaceae	Perennial	N	NA
278	*Cleome viscosa* L.	Asian spiderflower	-	Cleomaceae	Annual	N	NA
279	*Clinopodium capitellatum* (Benth.) Kuntze	Calamint	-	Lamiaceae	Perennial	N	LC
280	*Coix lacryma-jobi* L	Job's Tears	Ran-maka	Poaceae	Annual	N	NA
281	*Colocasia esculenta* (L.) Schott	Taro	Aaloo	Araceae	Perennial	N	LC
282	*Commelina benghalensis* L.	Bengal Dayflower	Kena	Commelinaceae	Annual	N	NA
283	*Commelina caroliniana* Walter	Carolina Dayflower	-	Commelinaceae	Annual	N	LC
284	*Commelina forskaolii* Vahl	Taro	Kanpet	Commelinaceae	Annual	N	NA
285	*Corchorus capsularis* L.	White jute	Chonche	Tiliaceae	Annual	N	NA
286	*Corchorus fascicularis* Lam.	-	-	Tiliaceae	Annual	N	NA
287	*Corchorus olitorius* L.	Nalta Jute	Banpat	Tiliaceae	Annual	N	NA
288	*Cosmos bipinnatus* Cav.	Mexican aster	-	Asteraceae	Annual	E	NA
289	*Crinum asiaticum* L.	Spider lily	-	Amarylidaceae	Perennial	N	NA
290	*Crotalaria hebecarpa* (DC.) Rudd	Fuzzy Fruited Rattlepod	Godhadi	Fabaceae	Annual	N	NA
291	*Cryptostegia grandiflora* Roxb. ex R.Br.	Rubber vine	-	Apocynaceae	Perennial	E	NA

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292	*Curculigo orchioides* Gaertn.	Golden Eye Grass	Kali-musali	Hypoxidaceae	Perennial	N	NA
293	*Cyanotis fasciculata* (B.Heyne ex Roth) Schult	Nilvanti	-	Commelinaceae	Annual	N	LC
294	*Cyanthillium cinereum* (L.) H.Rob.	Little ironweed	Sahadevi	Asteraceae	Annual	N	NA
295	*Cymbopogon martini* (Roxb.) W.Watson	Rosha grass	Rohis	Poaceae	Perennial	N	NA
296	*Cynodon dactylon* (L.) Pers.	Bermuda Grass	Durva	Poaceae	Perennial	N	NA
297	*Cyperus alopecuroides* Rottb.	Foxtail Sedge	-	Cyperaceae	Perennial	E	LC
298	*Cyperus compressus* L.	Poorland Flat Sedge	Emend	Cyperaceae	Annual	N	LC
299	*Cyperus difformis* L	Variable Flatsedge	-	Cyperaceae	Annual	E	LC
300	*Cyperus iria* L.	Rice Flat Sedge	-	Cyperaceae	Annual	N	LC
301	*Cyperus nutans* Vahl i	-	-	Cyperaceae	Perennial	N	LC
302	*Cyperus pangorei* Rottb	Pangorai	-	Cyperaceae	Perennial	N	LC
303	*Cyperus rotundus* retzii Kük.	Common Nut Sedge	Barik Motha	Cyperaceae	Perennial	N	LC
304	*Cyperus alulatus* J.Kern,	-	-	Cyperaceae	Annual	N	LC
305	*Cyperus digitatus* Roxb.	Finger Flatsedge	-	Cyperaceae	Perennial	N	LC
306	*Cyperus squarrosus* L.	Bearded Flatsedge	-	Cyperaceae	Annual	N	LC
307	*Dactyloctenium aegyptium* (L.) Willd.	Crowfoot Grass	-	Poaceae	Annual	E	NA
308	*Datura innoxia* Mill.	-	Dhotra	Solanaceae	Perennial	E	NA
309	*Datura metel* L.	Devil's Trumpet	Datura	Solanaceae	Perennial	N	NA
310	*Dendrocalamus strictus* Roxb.	Calcutta Bamboo	-	Poaceae	Perennial	N	NA
311	*Dichanthium annulatum* (Forssk.) Stapf	Sheda Grass	Marvel	Poaceae	Perennial	N	NA
312	*Dicliptera cuneata* Nees	Wedge-Leaf Foldwing	-	Acanthaceae	Perennial	N	NA
313	*Dicliptera paniculata (*Forssk.*)* I.Darbysh.	Panicled Foldwing	Kali anghedi	Acanthaceae	Perennial	N	NA
314	*Digitaria ciliaris* (Retz.) Koeler	Wild Crabgrass	-	Poaceae	Annual	N	NA
315	*Dinebra retroflexa* (Vahl) Panz.	Viper grass	-	Poaceae	Annual	E	NA
316	*Diplocyclos palmatus* (L.)C. Jeffrey	Lollipop climber	Kauroli	Cucurbitaceae	Annual	N	NA
317	*Echinochloa colona* (L.) Link	Jungle grass	Jiria	Poaceae	Annual	N	LC

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318	*Echinops echinatus* Roxb.	Indian Globe Thistle	Utkatar	Asteraceae	Perennial	N	NA
319	*Eclipta prostrata* (L.) L.	False Daisy	Bhringaraj	Poaceae	Annual	N	LC
320	*Eichhornia crassipes* (Mart.) Solms	Common water hyacinth	Jalkumbhi	Pontederiaceae	Perennial	E	NA
321	*Eleocharis acutangula* (Roxb.) Schult.	-	-	Cyperaceae	Perennial	N	NA
322	*Eleocharis atropurpurea* (Retz.) J.Presl & C.Presl	-	-	Cyperaceae	Annual	N	LC
323	*Eleocharis geniculata* (L.) Roem. & Schult.	-	-	Cyperaceae	Annual	N	LC
324	*Eleusine indica* (L.) Gaertn.	Indian Crowfoot Grass	Rannachani	Poaceae	Annual	N	LC
325	*Emilia sonchifolia* (L.) DC. ex DC.	Purple Sow Thistle	Dhamapan	Asteraceae	Annual	N	NA
326	*Enicostema axillare* (Poir. ex Lam.) A.Raynal	Indian Whitehead	Chota-karait	Gentianaceae	Perennial	N	NA
327	*Eragrostis gangetica* (Roxb.) Steud.	-	-	Poaceae	Annual	E	NA
328	*Eragrostis unioloides* (Retz.) Nees ex Steud.	Chinese lovegrass	Seete-che-pohe	Poaceae	Annual	N	LC
329	*Erigeron sublyratus* Roxb. ex DC.	-	-	Asteraceae	Annual	N	NA
330	*Euphorbia fusiformis* Buch.-Ham. ex D.Don	Asthma Weed	Khir-kand	Euphorbiaceae	Annual	N	NA
331	*Euphorbia heterophylla* L.	-	Wild spurge	Euphorbiaceae	Annual	E	NA
332	*Euphorbia hirta* L.	Asthma Weed	Dudhi	Euphorbiaceae	Annual	N	NA
333	*Euphorbia notoptera* Boiss.	Winged Seed Spurge	-	Euphorbiaceae	Annual	N	NA
334	*Euphorbia thymifolia* L.	Close up of the flowers	Lahan Dudhi	Euphorbiaceae	Annual	E	NA
335	*Euphorbia heterophylla* L	Wild Poinsettia	-	Euphorbiaceae	Annual	E	NA
336	*Evolvulus alsinoides* (L.) L.	Dwarf Morning Glory	Vishnukranta	Convolvulaceae	Perennial	E	NA
337	*Exacum pedunculatum* L	Stalked Persian Violet	-	Gentianaceae	Annual	N	NA
338	*Fimbristylis ferruginea* (L.) Vahl	-	-	Cyperaceae	Perennial	N	LC
339	*Fimbristylis ovata* (Burm.f.) J.Kern	Flat spike sedge	-	Cyperaceae	Perennial	E	LC
340	*Fimbristylis tetragona R.Br*	-	-	Cyperaceae	Annual	N	LC
341	*Fuirena cuspidata* (Roth) Kunth	-	-	Cyperaceae	Perennial	N	NA

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342	*Fumaria indica* (Hausskn.) Pugsley	Indian Fumitory	Papara	Papaveraceae	Annual	N	NA
343	*Glinus lotoides* L.	Lotus sweetjuice	Kotak	Molluginaceae	Annual	N	NA
344	*Gomphrena serrata* L.	Prostrate Gomphrena	-	Amaranthaceae	Perennial	E	NA
345	*Grangea maderaspatana* (L.) Poir.	Madras Carpet	Mashipatri	Asteraceae	Annual	N	LC
346	*Heliotropium indicum* L.	Indian turnsole	Bhurundi	Boraginaceae	Annual	N	NA
347	*Heteropogon contortus* (L.) P.Beauv. ex Roem. & Schult.	Black Speargrass	Surwal	Poaceae	Perennial	N	NA
348	*Hibiscus hirtus* L.	Lesser Mallow	Dupari	Malvaceae	Perennial	N	NA
349	*Hoppea dichotoma* Willd.	Indian Hoppea	-	Gentianaceae	Annual	N	LC
350	*Hydrilla verticillata* (L.f.) Royle	Waterthyme	-	Hydrocharitaceae	Perennial	N	LC
351	*Hygrophila schulli* (Buch.-Ham.) M.R.Almeida & S.M. Almeida	Gokulakanta	Talimkhana	Acanthaceae	Perennial	N	LC
352	*Hyptis suaveolens* (L.) Poit.	American Mint	Jungli tulas	Lamiaceae	Annual	E	NA
353	*Indigofera linnaei* Ali	Birdsville Indigo	Bhingule	Fabaceae	Perennial	N	NA
354	*Ipomoea aquatica* Forssk.	Water Morning Glory	Nalichi-bhaji	Convolvulaceae	Perennial	N	LC
355	*Justicia adhatoda* L.	Malabar Nit	Adhulsa	Acanthaceae	Evergreen	N	NA
356	*Kyllinga brevifolia* Rottb.	Shortleaf spikesedge	-	Cyperaceae	Perennial	E	LC
357	*Lagascea mollis* Cav.	Silk leaf	Tharvad	Asteraceae	Annual	E	NA
358	*Launaea procumbens* (Roxb.) Ramayya & Rajagopal	Creeping Launaea	Pathari	Asteraceae	Perennial	N	NA
359	*Lavandula bipinnata* (Roth) Kuntze	Feather-leaved Lavender	Ghodegui	Lamiaceae	Perennial	N	NA
360	*Lemna perpusilla* Torr.	Common duck weed	-	Araceae	Perennial	E	LC
361	*Lemna gibba* L.	Fat Duckweed	-	Lemnaceae	Perennial	E	LC
362	*Lepidagathis cristata* Willd.	Crested Lepidagathis	Bhui Gend	Acanthaceae	Perennial	N	NA
363	*Leucas aspera* (Willd.) Link	Common Leucas	Tamba	Lamiaceae	Annual	N	NA
364	*Limnophila indica* (L.) Druce	Indian Marshweed	Ambuli	Plantaginaceae	Perennial	N	LC

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365	*Lobelia alsinoides* Lam.	Chickweed Lobelia	-	Campanulaceae	Annual	N	LC
366	*Ludwigia octovalvis* (Jacq.) P.H.Raven	Willow Primrose	Pan lavang	Onagraceae	Perennial	N	LC
367	*Malachra capitata* (L.) L.	Brazil Jute	-	Malvaceae	Annual	E	NA
368	*Malvastrum coromandelianum* (L.) Garcke	False Mallow	-	Malvaceae	Annual	N	NA
369	*Melanocenchris jacquemontii* Jaub. & Spach	-	-	Poaceae	Annual	N	NA
370	*Monsonia senegalensis* Guill. & Perr.	Pink Monsonia	Varsharani	Geraniaceae	Annual	N	NA
371	*Najas indica* (Willd.) Cham.	Guppy Grass	-	Hydrocharitaceae	Annual	N	LC
372	*Nymphoides hydrophylla* (Lour.) Kuntze	Crested Floatingheart	Kumudini	Menyanthaceae	Annual	N	LC
373	*Ottelia alismoides* (L.) Pers.	Duck Lettuce	Olek-alsem	Hydrocharitaceae	Perennial	N	LC
374	*Oxalis corniculata* L.	Creeping Wood Sorrel	Amrul	Oxalidaceae	Perennial	E	LC
375	*Panicum repens* L.	Creeping panic	-	Poaceae	Perennial	N	LC
376	*Parthenium hysterophorus* L.	Carrot grass	Gajargavat	Asteraceae	Annual	E	NA
377	*Paspalidium flavidum* (Retz.) A.Camus	Yellow Watercrown Grass	-	Poaceae	Perennial	N	LC
378	*Persicaria glabra* (Willd.) M.Gómez	Denseflower Knotweed	Sheral	Polygonaceae	Annual	N	LC
379	*Phyla nodiflora* (L.) Greene	Frog fruit	Jalapimpali	Verbenaceae	Perennial	N	LC
380	*Physalis minima* L.	Ground Cherry	Ran-popti	Solanaceae	Perennial	N	LC
381	*Pistia stratiotes* L.	Water Lettuce	Gondala	Araceae	Perennial	N	LC
382	*Polygala arvensis* Willd.	Field Milkwort	Sanjivani	Polygalaceae	Annual	N	NA
383	*Portulaca oleracea* L.	Common Purselane	Purslane	Portulacaceae	Annual	N	NA
384	*Pulicaria wightiana* (DC.) C.B.Clarke	-	Sontikli	Asteraceae	Annual	N	NA
385	*Saccharum spontaneum* L.	Kans grass	Kamis	Poaceae	Perennial	N	LC
386	*Sansevieria trifasciata* Prain	Snake plant	-	Asparagaceae	Perennial	E	NA
387	*Senna uniflora*(Mill.) H.S.Irwin & Barneby	Oneleaf Senna	-	Caesalpiniaceae	Annual	E	NA
388	*Senna tora* (L.) Roxb.	Stinking Cassia	Takla	Caesalpiniaceae	Perennial	N	NA
389	*Sesamum indicum* L.	Sesame	White Til	Pedaliaceae	Annual	N	NA

SN	Scientific Name	Common name(English)	Local name(Marathi)	Family	Habitat	Origin	IUCN status
390	*Setaria viridis* (L.) P.Beauv.	Green Foxtail	-	Poaceae	Annual	N	NA
391	*Sida rhombifolia* L.	Cuban jute	Sadeda	Malvaceae	Annual	N	NA
392	*Sida acuta* Burm.f.	Common Wireweed	Chikana	Malvaceae	Perennial	N	NA
393	*Sida cordata* (Burm.f.) Borss.Waalk.	Long-stalk Sida	Bhumi Petari	Malvaceae	Perennial	N	NA
394	*Solanum virginianum* L.	Thorny nightshade	Kateringani	Solanaceae	Perennial	N	NA
395	*Sonchus asper* (L.) Hill	Prickly Sow-Thistle	Mhatara	Asteraceae	Annual	N	NA
396	*Sonchus oleraceus* (L.) L.	Hare's-lettuce	-	Asteraceae	Annual	N	NA
397	*Sopubia delphinifolia* G.Don	Common Sopubia	Dudhali	Scrophulariaceae	Annual	N	NA
398	*Spermacoce pusilla* Wall.	Tiny False Buttonweed	Tarakadal	Rubiaceae	Annual	N	NA
399	*Sphaeranthus indicus* L.	East Indian Globe Thistle	-	Asteraceae	Annual	N	LC
400	*Striga densiflora* (Benth.) Benth.	Denseflower Witchweed	Agya	Orobanchaceae	Annual	N	NA
401	*Striga gesneroides var. gesneroides*	Purple Witchweed	Bambaku	Orobanchaceae	Annual	N	NA
402	*Synedrella nodiflora* (L.) Gaertn.	Cinderella Weed	-	Asteraceae	Annual	E	NA
403	*Tagetes erecta* L.	Mexican marigold	-	Asteraceae	Annual	E	NA
404	*Thelepogon elegans* Roth	-		Poaceae	Annual	N	NA
405	*Trichodesma indicum* (L.) Lehm.	Indian Borage	Chota Kalpa	Boraginaceae	Annual	N	NA
406	*Tricholepis amplexicaulis* C.B.Clarke	-	Dahan	Asteraceae	Annual	N	NA
407	*Tridax procumbens* (L.) L.	Tridax Daisy	Dagadi pala	Asteraceae	Annual	E	NA
408	*Typha angustifolia* L.	Lesser Indian Reed Mace,	Pan-kanis	Typhaceae	Perennial	N	LC
409	*Urena lobata* L.	Caesarweed	Vanbhendi	Malvaceae	Perennial	E	NA
410	*Vallisneria spiralis* L.	Tape grass	Jallil	Hydrocharitaceae	Perennial	N	LC
411	*Verbascum thapsus* L.	Chinese Mullein	Kutki	Scrophulariaceae	Annual	N	NA
412	*Vigna trilobata* (L.) Verdc	Wild Gram	Mungan	Fabaceae	Annual	N	NA
413	*Withania somnifera* (L.) Dunal	Indian ginseng	Ashwagandha	Solanaceae	Perennial	N	NA

SN	Scientific Name	Common name(English)	Local name(Marathi)	Family	Habitat	Origin	IUCN status
414	*Wolffia arrhiza* (L.) Horkel ex Wimm.	Rootless duckweed	-	Araceae	Annual	N	LC
415	*Xanthium strumarium* L.	Common Cocklebur	Landga	Asteraceae	Annual	N	NA
416	*Zornia diphylla* (L.) Pers.	Two-Leaf Zornia	-	Fabaceae	Annual	N	NA
LC- LEAST CONCERN,VU-VULNERABLE,NT-NEAR THREATNED, NA- NOT ASSESSED, DD-DATA DEFICIENT, E-EXOTIC, N-NATIVE (Source: Primary Survey, Data from Garden Department PCMC and Data from interaction with Dr. Pravin Cholke)							

Annexure 3: List of Birds species in PCMC

SN	Common Name	Scientific Name	Family	IUCN status	WPA Status	CITES
1	Ashy Prinia	*Prinia socialis*	Cisticolidae	LC	-	-
2	Ashy-crowned Sparrow-lark	*Eremopterix griseus*	Alaudidae	LC	IV	-
3	Asian Brown Flycatcher	*Muscicapa dauurica*	Muscicapidae	LC	IV	-
4	Asian Koel	*Eudynamys scolopaceus*	Cuculidae	LC	-	-
5	Asian Openbill	*Anastomus oscitans*	Ciconiidae	LC	-	-
6	Barn Owl	*Tyto alba*	Tytonidae	LC	IV	II
7	Barn Swallow	*Hirundo rustica*	Hirundinidae	LC	-	-
8	Baya Weaver	*Ploceus philippinus*	Ploceidae	LC	IV	-
9	Black Drongo	*Dicrurus macrocercus*	Dicruridae	LC	IV	-
10	Black Kite	*Milvus migrans*	Accipitridae	LC	-	II
11	Black Redstart	*Phoenicurus ochruros*	Muscicapidae	LC	-	-
12	Black-crowned Night Heron	*Nycticorax nycticorax*	Ardeidae	LC	IV	-
13	Black-headed Ibis	*Threskiornis melanocephalus*	Threskiornithidae	NT	IV	-
14	Black-winged Kite	*Elanus caeruleus*	Accipitridae	LC	-	II
15	Black-winged Stilt	*Himantopus himantopus*	Recurvirostridae	LC	IV	-
16	Blue Rock Pigeon	*Columba livia*	Columbidae	LC	-	-
17	Blue Rock-Thrush	*Monticola solitarius*	Muscicapidae	LC	-	-
18	Blyth's Reed Warbler	*Acrocephalus dumetorum*	Acrocephalidae	LC	-	-

SN	Common Name	Scientific Name	Family	IUCN status	WPA Status	CITES
19	Booted Eagle	*Hieraaetus pennatus*	Accipitridae	LC	-	II
20	Booted Warbler	*Iduna caligata*	Acrocephalidae	LC	-	-
21	Brahminy Kite	*Haliastur indus*	Accipitridae	LC	-	-
22	Brahminy Starling	*Sturnia pagodarum*	Sturnidae	LC	IV	-
23	Cattle Egret	*Bubulcus ibis*	Ardeidae	LC	IV	-
24	Cinereous Tit	*Parus cinereus*	Paridae	-	IV	-
25	Citrine Wagtail	*Motacilla citreola*	Motacillidae	LC	-	-
26	Combed Duck	*Sarkidiornis melanotos*	Anatidae	LC	IV	II
27	Common Coot	*Fulica atra*	Rallidae	LC	IV	-
28	Common Hoopoe	*Upupa epops*	Upupidae	LC	-	-
29	Common Iora	*Aegithina tiphia*	Aegithinidae	LC	IV	-
30	Common Kestrel	*Falco tinnunculus*	Falconidae	LC	IV	II
31	Common Kingfisher	*Alcedo atthis*	Alcedinidae	LC	IV	-
32	Common Moorhen	*Gallinula chloropus*	Rallidae	LC	-	-
33	Common Myna	*Acridotheres tristis*	Sturnidae	LC	IV	-
34	Common Sandpiper	*Actitis hypoleucos*	Scolopacidae	LC	IV	-
35	Common Stonechat	*Saxicola torquatus*	Muscicapidae	LC	-	-
36	Common Tailorbird	*Orthotomus sutorius*	Sylviidae	LC	-	-
37	Common Teal	*Anas crecca*	Anatidae	LC	IV	-
38	Coppersmith Barbet	*Psilopogon haemacephalus*	Megalaimidae	LC	IV	-
39	Dusky Crag-Martin	*Ptyonoprogne concolor*	Hirundinidae	LC	-	-
40	Eurasian Hobby	*Falco subbuteo*	Falconidae	LC	IV	II
41	Eurasian Marsh Harrier	*Circus aeruginosus*	Accipitridae	LC	-	II
42	Gadwall	*Mareca strepera*	Anatidae	LC	IV	-
43	Garganey	*Spatula querquedula*	Anatidae	LC	IV	-
44	Glossy Ibis	*Plegadis falcinellus*	Threskiornithidae	LC	IV	-
45	Gray Francolin	*Francolinus pondicerianus*	Phasianidae	LC	-	-

SN	Common Name	Scientific Name	Family	IUCN status	WPA Status	CITES
46	Great Cormorant	*Phalacrocorax carbo*	Phalacrocoracidae	LC	IV	-
47	Great Egret	*Ardea alba*	Ardeidae	LC	IV	-
48	Greater Coucal	*Centropus sinensis*	Cuculidae	LC	-	-
49	Green Bee-eater	*Merops orientalis*	Meropidae	LC	-	-
50	Green Sandpiper	*Tringa ochropus*	Scolopacidae	LC	IV	-
51	Grey Heron	*Ardea cinerea*	Ardeidae	LC	IV	-
52	Grey Wagtail	*Motacilla cinerea*	Motacillidae	LC	-	-
53	House Crow	*Corvus splendens*	Corvidae	LC	V	-
54	House Sparrow	*Passer domesticus*	Passeridae	LC	-	-
55	Indian Bushlark	*Mirafra erythroptera*	Alaudidae	LC	IV	-
56	Indian Cormorant	*Phalacrocorax fuscicollis*	Phalacrocoracidae	LC	IV	-
57	Indian Golden Oriole	*Oriolus kundoo*	Oriolidae	LC	IV	-
58	Indian Grey Hornbill	*Ocyceros birostris*	Bucerotidae	LC	-	-
59	Indian Nightjar	*Caprimulgus asiaticus*	Caprimulgidae	LC	IV	-
60	Indian Paradise Flycatcher	*Terpsiphone paradisi*	Monarchidae	LC	-	-
61	Indian Peafowl	*Pavo cristatus*	Phasianidae	LC	I	III
62	Indian Pond Heron	*Ardeola grayii*	Ardeidae	LC	-	-
63	Indian Robin	*Saxicoloides fulicatus*	Motacillidae	LC	-	-
64	Indian Roller	*Coracias benghalensis*	Coraciidae	LC	IV	-
65	Indian Silverbill	*Euodice malabarica*	Estrildidae	LC	-	-
66	Intermediate Egret	*Ardea intermedia*	Ardeidae	LC	IV	-
67	Jungle Bush-Quail	*Perdicula asiatica*	Phasianidae	LC	IV	-
68	Jungle Myna	*Acridotheres fuscus*	Sturnidae	LC	IV	-
69	Large Grey Babbler	*Turdoides malcolmi*	Leiothrichidae	LC	IV	-
70	Large-billed Crow (Jungle Crow)	*Corvus macrorhynchos*	Corvidae	LC	-	-
71	Laughing Dove	*Spilopelia senegalensis*	Columbidae	LC	IV	-
72	Lesser Whistling Duck	*Dendrocygna javanica*	Anatidae	LC	IV	-

SN	Common Name	Scientific Name	Family	IUCN status	WPA Status	CITES
73	Little Cormorant	*Microcarbo niger*	Phalacrocoracidae	LC	IV	-
74	Little Egret	*Egretta garzetta*	Ardeidae	LC	-	-
75	Little Grebe	*Tachybaptus ruficollis*	Podicipedidae	LC	IV	-
76	Long-legged Buzzard	*Buteo rufinus*	Accipitridae	LC	-	II
77	Long-Tailed Shrike	*Lanius schach*	Laniidae	LC	-	-
78	Northern Pintail	*Anas acuta*	Anatidae	LC	IV	-
79	Northern Shoveler	*Spatula clypeata*	Anatidae	LC	IV	-
80	Oriental Honey Buzzard	*Pernis ptilorhynchus*	Accipitridae	LC	-	II
81	Oriental Magpie-robin	*Copsychus saularis*	Muscicapidae	LC	-	-
82	Oriental Whiteeye	*Zosterops palpebrosus*	Zosteropidae	LC	-	-
83	Osprey	*Pandion haliaetus*	Pandionidae	LC	I	II
84	Paddyfield Pipit	*Anthus rufulus*	Motacillidae	LC	-	-
85	Painted Stork	*Mycteria leucocephala*	Ciconiidae	NT	IV	-
86	Peregrine Falcon	*Falco peregrinus*	Falconidae	LC	I	I
87	Pied Bushchat	*Saxicola caprata*	Muscicapidae	LC	-	-
88	Pied Kingfisher	*Ceryle rudis*	Alcedinidae	LC	IV	-
89	Plain Prinia	*Prinia inornata*	Cisticolidae	LC	-	-
90	Purple heron	*Ardea purpurea*	Ardeidae	LC	-	-
91	Purple Moorhen	*Porphyrio porphyrio*	Rallidae	LC	-	-
92	Purple Sunbird	*Cinnyris asiaticus*	Nectariniidae	LC	IV	-
93	Purple-rumped Sunbird	*Nectarinia zeylonica*	Nectariniidae	LC	IV	-
94	Red Avadavat	*Amandava amandava*	Estrildidae	LC	-	-
95	Red-breasted Flycatcher	*Ficedula parva*	Muscicapidae	LC	IV	-
96	Red-naped Ibis	*Pseudibis papillosa*	Threskiornithidae	LC	IV	-
97	Red-vented Bulbul	*Pycnonotus cafer*	Pycnonotidae	LC	-	-
98	Red-wattled Lapwing	*Vanellus indicus*	Charadriidae	LC	-	-
99	Red-whiskered Bulbul	*Pycnonotus jocosus*	Pycnonotidae	LC	IV	-

SN	Common Name	Scientific Name	Family	IUCN status	WPA Status	CITES
100	River Tern	*Sterna aurantia*	Laridae	NT	-	-
101	Rock Bush-quail	*Perdicula argoondah*	Phasianidae	LC	IV	-
102	Rose-ringed Parakeet	*Psittacula krameri*	Psittacidae	LC	IV	NC
103	Rosy starling	*Pastor roseus*	Sturnidae	LC	IV	-
104	Ruddy shelduck	*Tadorna ferruginea*	Anatidae	LC	IV	-
105	Rufous Treepie	*Dendrocitta vagabunda*	Corvidae	LC	-	-
106	Rufous-tailed Lark	*Ammomanes phoenicura*	Alaudidae	LC	IV	-
107	Scaly-breasted Munia	*Lonchura punctulata*	Estrildidae	LC	IV	-
108	Shikra	*Accipiter badius*	Accipitridae	LC	-	II
109	Short-toed Snake Eagle	*Circaetus gallicus*	Accipitridae	LC	-	II
110	Small Minivet	*Pericrocotus cinnamomeus*	Campephagidae	LC	IV	-
111	Spot-billed Duck	*Anas poecilorhyncha*	Anatidae	LC	IV	-
112	Spotted Owlet	*Athene brama*	Strigidae	LC	-	II
113	Striolated Bunting	*Emberiza striolata*	Emberizidae	LC	IV	-
114	Syke's Lark	*Galerida deva*	Alaudidae	LC	IV	-
115	Taiga Flycatcher	*Ficedula albicilla*	Muscicapidae	LC	IV	-
116	Tawny Eagle	*Aquila rapax*	Accipitridae	VU	-	II
117	Thick-billed Flowerpecker	*Dicaeum agile*	Dicaeidae	LC	-	-
118	Tickell's Blue Flycatcher	*Cyornis tickelliae*	Muscicapidae	LC	IV	-
119	Tree pipit	*Anthus trivialis*	Motacillidae	LC	IV	-
120	Whiskered Tern	*Chlidonias hybrida*	Laridae	LC	-	-
121	White Wagtail	*Motacilla alba*	Motacillidae	LC	-	-
122	White-breasted Kingfisher	*Halcyon smyrnensis*	Alcedinidae	LC	IV	-
123	White-breasted Waterhen	*Amaurornis phoenicurus*	Rallidae	LC	-	-
124	White-browed Fantail	*Rhipidura aureola*	Rhipiduridae	LC	-	-
125	White-browed Wagtail	*Motacilla maderaspatensis*	Motacillidae	LC	-	-
126	White-eyed Buzzard	*Butastur teesa*	Accipitridae	LC	-	II

SN	Common Name	Scientific Name	Family	IUCN status	WPA Status	CITES
127	White-spotted Fantail	*Rhipidura albogularis*	Rhipiduridae	LC	-	-
128	Wire-tailed Swallow	*Hirundo smithii*	Hirundinidae	LC	-	-
129	Wood sandpiper	*Tringa glareola*	Scolopacidae	LC	IV	-
130	Woolly-necked Stork	*Ciconia episcopus*	Ciconiidae	VU	IV	-
131	Wryneck	*Jynx torquilla*	Picidae	LC	-	-
132	Yellow Wagtail	*Motacilla flava*	Motacillidae	LC	-	-
133	Yellow-eyed babbler	*Chrysomma sinense*	Sylviidae	LC	IV	-
134	Yellow-legged Buttonquail	*Turnix tanki*	Turnicidae	LC	IV	-
135	Little Swift	*Apus affinis*	Apodidae	LC	-	-
136	Asian Palm Swift	*Cypsiurus balasiensis*	Apodidae	LC	-	-
LC= Least Concern, VU= Vulnerable, NT= Near Threatened (Source: Primary Survey, Data from ebird.org)						

Annexure 4: List of Butterflies in PCMC

No.	Common Name	Scientific Name	Family
1	Babul Blue	*Azanus jesous*	Lycaenidae
2	Blue Pansy	*Junonia orithya*	Nymphalidae
3	Blue Tiger	*Tirumala limniace*	Nymphalidae
4	Chocolate Pansy	*Junonia iphita*	Nymphalidae
5	Common Baron	*Euthalia aconthea*	Nymphalidae
6	Common Cerulean	*Jamides celeno*	Lycaenidae
7	Common Evening Brown	*Melanitis leda*	Nymphalidae
8	Common Grass Yellow	*Eurema hecabe*	Pieridae
9	Common Gull	*Cepora nerissa*	Pieridae
10	Common hedge blue	*Acytolepis puspa*	Lycaenidae
11	Common Lineblue	*Prosotas nora*	Lycaenidae
12	Common Mormon	*Papilio polytes*	Papilionidae

No.	Common Name	Scientific Name	Family
13	Common Pierrot	*Castalius rosimon*	Lycaenidae
14	Common Rose	*Pachliopta aristolochiae*	Papilionidae
15	Common Silverline	*Spindasis vulcanus*	Lycaenidae
16	Common Three ring	*Ypthima asterope*	Nymphalidae
17	Common Wanderer	*Pareronia hippia*	Pieridae
18	Danaid Eggfly	*Hypolimnas misippus*	Nymphalidae
19	Dark Grass Blue	*Zizeeria karsandra*	Lycaenidae
20	Gram Blue	*Euchrysops cnejus*	Lycaenidae
21	Great Eggfly	*Hypolimnas bolina*	Nymphalidae
22	Grey Pansy	*Junonia atlites*	Nymphalidae
23	Indian Jezebel	*Delias eucharis*	Pieridae
24	Lemon Emigrant	*Catopsilia pomona*	Pieridae
25	Lemon Pansy	*Junonia lemonias*	Nymphalidae
26	Lesser Grass Blue	*Zizina otis*	Lycaenidae
27	Parnara Swift	*Parnara spp.*	Hesperiidae
28	Peacock pansy	*Junonia almana*	Nymphalidae
29	Pioneer	*Belenois aurota*	Pieridae
30	Plain Tiger	*Danaus chrysippus*	Nymphalidae
31	Red Flash	*Rapala iarbus*	Lycaenidae
32	Red Pierrot	*Talicada nyseus*	Lycaenidae
33	Small Cupid	*Chilades parrhasius*	Lycaenidae
34	Striped Pierrot	*Tarucus nara*	Lycaenidae
35	Striped Tiger	*Danaus genutia*	Nymphalidae
36	Tailless Lineblue	*Prosotas dubiosa*	Lycaenidae
37	Tawny Coster	*Acraea terpsicore*	Nymphalidae
38	White-orange tip	*Ixias marianne*	Pieridae
39	Yellow orange Tip	*Ixias pyrene*	Pieridae

No.	Common Name	Scientific Name	Family
40	Yellow Pansy	*Junonia hierta*	Nymphalidae
41	Zebra Blue	*Leptotes plinius*	Lycaenidae
42	Common Leopard	*Phalanta phalantha*	Nymphalidae
43	Lime Swallowtail	*Papilio demoleus*	Papilionidae
44	Blue Mormon	*Papilio polymnestor*	Papilionidae
45	Little Orange-tip	*Colotis etrida*	Pieridae
46	Common Five-ring	*Ypthima baldus*	Nymphalidae
47	Angled Pierrot	*Caleta decidia*	Lycaenidae
48	Tailed Jay	*Graphium agamemnon*	Papilionidae
49	Common Castor	*Ariadne merione*	Nymphalidae
50	Baronet	*Symphaedra nais*	Nymphalidae
(Source: Primary Survey)			

Annexure 5: List of Fresh Water fishes in PCMC

No.	Scientific Name	Family	IUCN status
1	*Notopterus notopterus*	Notopteridae	LC
2	*Catla catla*	Cyprinidae	-
3	*Cirrhinus fulungee*	Cyprinidae	LC
4	*Cirrhinus reba*	Cyprinidae	-
5	*Cirrhinus mrigala*	Cyprinidae	LC
6	*Labeo ariza*	Cyprinidae	LC
7	*Labeo boggut*	Cyprinidae	LC
8	*Labeo calbasu*	Cyprinidae	LC
9	*Labeo porcellus*	Cyprinidae	LC
10	*Labeo rohita*	Cyprinidae	LC
11	*Osteobrama cotio*	Cyprinidae	LC

No.	Scientific Name	Family	IUCN status
12	*Osteobrama neilli*	Cyprinidae	LC
13	*Osteobrama vigorsii*	Cyprinidae	LC
14	*Puntius amphibius*	Cyprinidae	DD
15	*Puntius conchonius*	Cyprinidae	LC
16	*Puntius jerdoni*	Cyprinidae	LC
17	*Puntius sarana*	Cyprinidae	LC
18	*Puntius sophore*	Cyprinidae	LC
19	*Puntius ticto*	Cyprinidae	LC
20	*Rohtee ogilbii*	Cyprinidae	LC
21	*Amblypharyngodon mola*	Cyprinidae	LC
22	*Salmophasia balookee*	Cyprinidae	LC
23	*Salmophasia boopis*	Cyprinidae	LC
24	*Salmophasia novacula*	Cyprinidae	LC
25	*Devario aequipinnatus*	Cyprinidae	LC
26	*Rasbora daniconius*	Cyprinidae	LC
27	*Crossocheilus latius*	Cyprinidae	LC
28	*Garra mullya*	Cyprinidae	LC
29	*Acanthocobitis mooreh*	Balitoridae	-
30	*Nemachilichthys rueppelli*	Balitoridae	LC
31	*Noemacheilus anguilla*	Balitoridae	-
32	*Schistura denisoni*	Balitoridae	LC
33	*Lepidocephalichthys thermalis*	Cobitidae	LC
34	*Mystus bleekeri*	Bagridae	LC
35	*Mystus seengtee*	Bagridae	LC
36	*Rita gogra*	Bagridae	LC
37	*Sperata seenghala*	Bagridae	LC
38	*Neotropius khavalchor*	Schilbeidae	DD

No.	Scientific Name	Family	IUCN status
39	*Clarias gariepinus*	Claridae	LC
40	*Heteropneustes fossilis*	Heteropneustidae	LC
41	*Xenentodon cancila*	Belonidae	LC
42	*Poecilia reticulata*	Poeciliidae	-
43	*Chanda nama*	Ambassidae	LC
44	*Oreochromis mossambicus*	Cichlidae	NT
45	*Glossogobius giuris*	Gobiidae	LC
46	*Channa marulius*	Channidae	LC
47	*Channa punctata*	Channidae	LC
DD= Data deficient, LC= Least Concern, NT= Near Threatened (Source: Primary Data)			

Annexure 6: List of Mammals in PCMC

No.	Common Name	Scientific Name	Family	IUCN status	WPA Status	CITES
1	Five Striped Palm Squirrel	*Funambulus pennantii*	Sciuridae	LC	IV	-
2	Mongoose	*Herpestes edwardsii*	Herpestidae	LC	II	III
3	Indian Flying Fox	*Pteropus giganteus*	Pteropodidae	LC	V	II
4	Indian Pygmy Bat	*Pipistrellus tenuis*	Vespertilionidae	LC	-	-
5	Black Rat	*Rattus rattus*	Muridae	LC	V	-
6	Grey Musk Shrew	*Suncus murinus*	Soricidae	LC	-	-
LC= Least Concern (Source: Primary Survey)						

Annexure 7: List of Invasive species in PCMC

Habit	SN	Scientific Name	Common name(English)	Local name(Marathi)	Family	Habitat
Trees	1	*Leucaena leucocephala* (Lam.) de Wit	Wild Tamrind	Subabhool	Mimosaceae	Evergreen
	2	*Prosopis juliflora* (Sw.) DC.	Algaroba	Vedi-babhul	Mimosaceae	Deciduous
	3	*Gliricidia sepium* (Jacq.) Kunth.ex.steud	Mexican Iiac	Saranga	Fabaceae	Deciduous
Shrubs	4	*Ipomoea carnea* Jacq.	Bush Morning Glory	Besharam	Convolvulaceae	Perennial
	5	*Ipomoea hederifolia* L.	Scarlet Morning Glory	Lal pungli	Convolvulaceae	Perennial
Herbs	6	*Parthenium hysteroporus* L.	Congress grass	Congress gavat	Asteraceae	Annual
	7	*Ageratum conyzoides* (L.) L	Goat weed	Ghanera osaadi	Asteraceae	Annual
	8	*Alternanthera paronychioides* A.St.-Hil.	Smooth chaff flower	-	Amaranthaceae	Perennial
	9	*Alternanthera philoxeroides* (Mart.) Griseb.	Alligator Weed	-	Amaranthaceae	Perennial
	10	*Alternanthera pungens* Kunth	Khaki Weed	Chibuk Kata	Amaranthaceae	Perennial
	11	*Argemone mexicana* L.	Mexican Prickly Poppy	Firangi dhotra	Papaveraceae	Annual
	12	*Chromolaena odorata* (L.) R.M.King & H.Rob.	Siam Weed	Ran-mari	Asteraceae	Perennial
	13	*Datura innoxia* Mill.	-	Dhotra	Solanaceae	Perennial
	14	*Eichhornia crassipes* (Mart.) Solms	Common water hyacinth	Jalkumbhi	Pontederiaceae	Perennial
	15	*Euphorbia heterophylla* L.		Wild spurge	Euphorbiaceae	Annual
	16	*Gomphrena serrata* L.	Prostrate Gomphrena		Amaranthaceae	Perennial
	17	*Hyptis suaveolens* (L.) Poit.	American Mint	Jungli tulas	Lamiaceae	Annual
	18	*Lagascea mollis* Cav.	Silk leaf	Tharvad	Asteraceae	Annual
	19	*Malachra capitata* (L.) L.	Brazil Jute		Malvaceae	Annual
	20	*Oxalis corniculata* L.	Creeping Wood Sorrel	Amrul	Oxalidaceae	Perennial
	21	*Senna uniflora* (Mill.) H.S.Irwin & Barneby	Oneleaf Senna		Caesalpiniaceae	Annual
	22	*Synedrella nodiflora* (L.) Gaertn.	Cinderella Weed		Asteraceae	Annual
	23	*Tridax procumbens* (L.) L.	Tridax Daisy	Dagadi pala	Asteraceae	Annual
	24	*Urena lobata* L.	Caesarweed	Vanbhendi	Malvaceae	Perennial

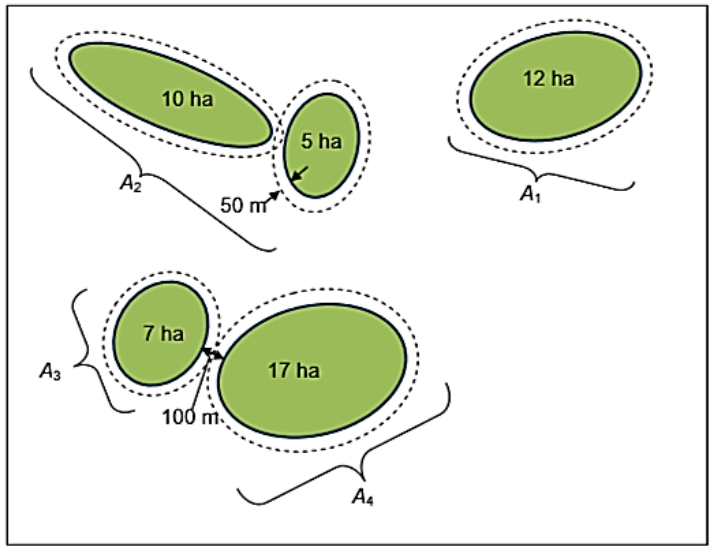
Annexure 8: Calculations of Indicator 2

Formula:

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

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

Example:



Calculation steps:

There are five patches in this landscape. We first add a buffer of 50 m around each patch to find out which patches are within 100m of each other: when the buffers overlap, the distance between the patches is less than 100m. The patch on the right (12 ha in size) is not connected to any other patches, and we name the patch A_1 (area = 12 ha). The two patches on the upper left are connected. Therefore, their areas have to be added, and we give this group of patches the name A_2 (area = 10 ha + 5 ha = 15 ha). The two patches at the bottom are exactly100m apart and therefore they are not considered connected and we give them the names A_3 (area = 7 ha) and A_4 (area = 17 ha). A_{total} is the sum of A_1, A_2, A_3 and A_4, i.e. A_{total} = 12 ha + 15 ha + 7 ha + 17 ha = 51 ha. We can now calculate the value of the effective mesh size for indicator 2 as

$$Indicator\,2 = \frac{1}{A_{total}}\left(A_1^2 + A_2^2 + A_3^2 + A_4^2\right) = \frac{1}{51\,\text{ha}}\left(12\times12\,\text{ha}^2 + 15\times15\,\text{ha}^2 + 7\times7\,\text{ha}^2 + 17\times17\,\text{ha}^2\right) = \frac{707}{51}\,\text{ha} = 13.86\,\text{ha}$$

Source: USER'S MANUAL ON THE SINGAPORE INDEX ON CITIES' BIODIVERSITY (also known as the City Biodiversity Index)

Annexure 9: Connectivity Areas for Indicator 2

Labels	No. of Natural Areas	Area (ha)	A^2	Ward No.
A1	1	32.8783	1080.983625	29
A2	1	0.8983	0.806910944	55
A3	1	1.2661	1.603030072	48
A4	1	1.2240	1.498218368	51
A5	1	1.9588	3.836839538	53
A6	1	2.8271	7.992303309	50
A7	1	0.1575	0.024806221	48
A8	1	0.0324	0.001049319	48
A9	1	0.6687	0.447136056	52
A10	1	0.0261	0.000683771	52
A11	1	0.0450	0.002025016	52
A12	1	0.0154	0.000237316	5
A13	1	0.0605	0.003655948	6
A14	1	0.4950	0.24502494	3
A15	1	0.4275	0.182756121	5
A16	1	0.0501	0.002514356	6
A17	1	0.3150	0.099225118	5
A18	1	1.0206	1.041607193	5
A19	1	0.1350	0.018224989	6
A20	1	0.0675	0.00455627	6
A21	1	0.0154	0.000237318	5
A22	1	0.0307	0.00094379	6
A23	1	6.2395	38.93198347	41
A24	1	0.6464	0.417779666	13
A25	1	0.2742	0.075193227	12
A26	1	0.1168	0.013639571	11
A27	1	0.2287	0.052284765	4
A28	1	2.5451	6.477695287	9
A29	1	0.6403	0.410016967	14
A30	1	0.5598	0.313351124	14
A31	1	0.3925	0.154026442	14
A32	1	0.1295	0.016766502	11
A33	1	0.3394	0.11521523	14
A34	1	0.4619	0.213389352	14
A35	1	0.4722	0.222952949	17
A36	1	0.1442	0.020781123	17
A37	1	0.4915	0.241562069	17
A38	1	0.9660	0.933240535	17
A39	1	0.0997	0.009933018	26
A40	1	1.2809	1.640751023	27
A41	1	0.8632	0.745038472	20

Labels	No. of Natural Areas	Area (ha)	A^2	Ward No.
A42	1	3.6393	13.24423218	17
A43	1	0.5130	0.263176053	27
A44	1	3.2387	10.48947814	27
A45	1	2.7141	7.366292622	29
A46	1	6.7620	45.72482053	37
A47	1	0.5235	0.274000041	29
A48	1	0.5048	0.254796428	29
A49	1	0.2291	0.052502337	29
A50	1	0.2659	0.070716137	20
A51	1	0.0522	0.002728839	41
A52	1	0.2165	0.046880598	39
A53	1	0.2657	0.07058866	44
A54	1	0.0746	0.005572229	43
A55	1	0.1015	0.010299309	44
A56	1	0.3566	0.127172456	37
A57	1	0.7888	0.622221207	35
A58	1	2.8599	8.178885721	56
A59	1	0.4151	0.172281254	58
A60	1	0.1317	0.017335005	40
A61	1	0.4291	0.184152714	28
A62	1	0.1533	0.023491177	32
A63	1	0.3715	0.137999165	60
A64	1	0.4560	0.20797224	37
A65	1	0.5547	0.307652502	28
A66	1	1.0742	1.153935158	33
A67	1	0.0986	0.009726463	29
A68	2	0.0450	0.002024989	54
A69	3	8.9607	80.2943268	55
A70	2	2.8140	7.918316765	55
A71	1	0.0900	0.008099981	53
A72	1	0.1877	0.035244244	53
A73	3	5.8965	34.76881009	53
A74	1	1.7833	3.180053677	Defence Area
A75	7	0.4202	0.176575611	55
A76	4	0.5400	0.291599628	53
A77	11	34.3082	1177.049523	53
A78	6	1.0659	1.13607605	55
A79	6	1.6312	2.660767793	55
A80	9	3.7692	14.20697325	48
A81	3	0.7324	0.536390264	55
A82	10	3.3515	11.23224152	53
A83	1	0.0307	0.000943796	48
A84	63	29.0679	844.9437847	53

Labels	No. of Natural Areas	Area (ha)	A^2	Ward No.
A85	4	2.4265	5.887808058	49
A86	1	0.0959	0.009192932	23
A87	2	0.5513	0.30390723	40
A88	3	8.1702	66.75146374	35
A89	2	6.0318	36.38203539	37
A90	2	0.5804	0.336833746	52
A91	3	0.1988	0.039517107	23
A92	4	0.7368	0.542833843	40
A93	1	3.8288	14.65945682	36
A94	2	0.4492	0.201736002	24
A95	8	23.5161	553.006337	40
A96	2	0.3073	0.094448263	24
A97	1	0.2215	0.049060136	28
A98	2	0.3864	0.149267547	24
A99	3	3.6876	13.5981901	29
A100	1	0.4138	0.17125426	27
A101	2	5.1240	26.25538752	21
A102	1	0.2859	0.081745136	21
A103	2	0.5947	0.353643528	29
A104	2	2.9459	8.67847254	26
A105	3	8.7648	76.8212026	27
A106	6	0.7350	0.5401571	16
A107	1	5.6986	32.47409786	16
A108	7	158.6733	25177.22659	28
A109	4	8.3435	69.61438332	26
A110	1	1.3806	1.906188576	8
A111	4	6.3186	39.92491839	8
A112	2	3.0303	9.182419955	17
A113	1	2.1666	4.694223654	26
A114	2	11.1483	124.2841756	9
A115	1	0.4946	0.244621204	14
A116	1	0.2673	0.071434323	14
A117	2	7.4682	55.77369902	14
A118	2	9.7454	94.97319173	9
A119	4	25.7579	663.4711447	10
A120	1	0.2047	0.041918432	14
A121	1	0.8010	0.641630895	14
A122	3	2.2228	4.940822087	13
A123	4	5.5321	30.60374163	4
A124	2	21.9027	479.7281043	19
A125	2	0.2040	0.041625657	11
A126	3	1.1116	1.235745377	14
A127	2	0.3582	0.128308859	11

Labels	No. of Natural Areas	Area (ha)	A^2	Ward No.
A128	1	1.3725	1.883756948	10
A129	2	1.3906	1.933731669	11
A130	4	1.6998	2.88915626	4
A131	5	8.6368	74.59491553	19
A132	2	0.0486	0.002366688	6
A133	3	1.7284	2.987472058	2
A134	4	1.7051	2.907214936	5
A135	3	17.9897	323.6296826	Defence Area
A136	16	5.9638	35.56678573	5
A137	3	0.0604	0.003648774	6
A138	3	48.3125	2334.100085	Defence Area
A139	172	233.0827	54327.53823	3
A140	1162	9592.8036	92021881.17	Along River

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Terracon Project Team

- Dr. Ramesh Madav – Project Guide
- Dr. C.S.Latoo – Project Advisor
- Mr. Ashok Jain – Project In-Charge
- Dr. Ninad Raut – Project Coordinator and Ecology Expert
- Mr. Akshay Nachane – Biodiversity Expert
- Mr. Abhijeet Jagtap – Fauna Expert
- Ms. Prachi Hatkar – Fauna Assistant
- Mr. Akshay Pandirkar – Aquatic Diversity Expert
- Mr. Ashwin Jagtap – Flora Expert
- Ms. Aarti More – Flora Assistant
- Ms. Sayee Girdhari – Flora Assistant
- Ms. Ekta Purswani – GIS and Ecologist
- Mr. Shailesh Kadam – GIS Expert

Authorized signature:

Dr. Ninad Raut
(Head – Ecology and Biodiversity)

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Terracon Ecotech Private Limited
202, Kingston, Tejpal Road, Vile Parle East, Mumbai – 400057
www.terraconindia.com