CITY BIODIVERSITY INDEX – JAMMU

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MESSAGE - LIEUTENANT GOVERNOR

LIEUTENANT GOVERNOR
JAMMU & KASHMIR

सत्यमेव जयते

आज़ादी का अमृत महोत्सव

RAJ BHAVAN
JAMMU-180001

I am happy to note that City Biodiversity Index has been developed for the smart city of Jammu, which will help the Administration to improve their understanding of its biodiversity wealth, leading them towards an effective governance mechanism and strategies for biodiversity conservation with the involvement of all stakeholders, especially the people of Jammu.

As the urban population grows, the role of the City Administration becomes more challenging to strike a balance between effective land use and management of natural ecosystems. This would ensure a clean environment beneficial to people and biodiversity.

The city of Jammu, also known as the City of Temples, has rich and rare assets in the form of its flora and fauna due to the presence of various natural ecosystems. We all have a responsibility to protect and improve these biologically diverse areas for posterity.

The City Biodiversity Index will also serve as a guiding tool for assessing the impacts of land use planning on urban biodiversity. This will ensure informed decision-making for conservation of biodiversity at local level and further create opportunities for stakeholders to come together for developing strategies to integrate the concerns of all life forms in city planning & management.

We are giving focused attention towards conservation and protection of our biodiversity and will work actively with the involvement of stakeholders. I compliment the Jammu and Kashmir Biodiversity Council, UNDP and ICLEI-Local Governments for Sustainability, South Asia for working together in developing the City Biodiversity Index of Jammu.

21st December, 2021
Jammu.

(Manoj Sinha)

MESSAGE - MAYOR, JAMMU MUNICIPAL CORPORATION

Chander Mohan Gupta
Mayor
Jammu Municipal Corporation

Message

Urban habitats depend on ecosystems and biological diversity both within and beyond the urban boundary. Healthy ecosystems in the cities have the potential to regulate climate, mitigate air and noise pollution, and offer opportunities for recreational and spiritual benefits.

To create a baseline for future monitoring of the status of biodiversity and ecosystem services in Jammu City, the Jammu and Kashmir Biodiversity Council has taken a unique initiative for the development of City Biodiversity Index based on the pattern of Singapore Biodiversity Index. The City Biodiversity Index guides on the major natural ecosystems & biodiversity concerns while planning the developmental activities. It is a significant step towards conservation and setting priorities for the actions to be taken for the conservation of our rich biological resources. The recommendations of ICLEI-Local Governments for Sustainability, South Asia under each indicator will serve as an assessment tool and help us to benchmark our biodiversity conservation efforts. This dynamic tool will also serve to improve governance in the city besides helping the local administration to follow biodiversity conservation guidelines.

I congratulate J&K Biodiversity Council and ICLEI-Local Governments for Sustainability, South Asia for working towards developing the City Biodiversity Indexfor Jammu City. I am sure the city administrators will benefit from the recommendations made in the document and work towards mitigating the pressures while developing Jammu as Smart City.

29/12/2021

(Chander Mohan Gupta)
Mayor

MESSAGE - CHIEF SECRETARY, JAMMU & KASHMIR

Dr. Arun Kumar Mehta, IAS

सत्यमेव जयते

Chief Secretary
Jammu & Kashmir

Message

Urban sustainability is realized when social, economic, and environmental aspects are all taken together. Biodiversity and ecosystem services are of great importance for maintaining the sustainability of a city. This is high time we assess the existing biodiversity of our smart cities. The City Biodiversity Index (CBI) is a tool that helps to measure and monitor the progress of the city in mainstreaming biodiversity conservation into urban governance.

The temple city of Jammu is interspersed with green spaces and is surrounded by wildlife protected areas which are repository of rich biodiversity. To ensure sustainable urban development in the city, we need to ensure sustainability of ecological services that support the city life.

Development of City Biodiversity Index Jammu is an initiative of paramount significance. I would like to take this opportunity to congratulate the Jammu and Kashmir Biodiversity Council for the positive step. I am sure the City Administration of Jammu shall take into consideration the recommendations made in planning and decision-making process to serve as an example for other towns and cities in the Union Territory of Jammu and Kashmir. I express my gratitude to ICLEI- Local Governments for Sustainability, South Asia for developing this index for Jammu. The financial support extended by UNDP through the SECURE Himalaya project for this initiative is also duly acknowledged.

(Dr. Arun Kumar Mehta)

MESSAGE - PRINCIPAL SECRETARY TO GOVERNMENT, DEPARTMENT OF HOUSING & URBAN DEVELOPMENT, J&K

सत्यमेव जयते

Dheeraj Gupta,
IAS

Pr. Secretary to Government
Department of Housing &
Urban Development

Message

Rapid urbanization is the most common feature worldwide in recent years. Consumption based urban lifestyle requires a huge quantum of natural resources and generates lots of waste leading to increasing pollution levels. Moreover, with the increasing population density, the environmental and ecological footprints of cities are increasing at an alarming pace.

The ecosystem services provided by the biodiversity in the urban areas are often undervalued and consequently the biodiversity conservation gets relegated to least priority.The development of City Biodiversity Index of Jammu to measure the ecological footprints as well as benchmark the biodiversity conservation efforts will play a significant role in implementation of biodiversity conservation related strategies. This is a welcome stepto strike a balance between development activities and biodiversity conservation.

The biodiversity conservation guidelines and suggestions given in the report will enable us to improve the scores for various indicators and encourage the administrators to enhance the protection measures for biodiversity conservation. This will consequently help to reduce the rate of loss of biodiversity in urban ecosystems and mitigate the environmental pressures exerted by the process of planned urbanization.

I am hopeful, the City Biodiversity Index will help in long term conservation of biodiversity and sustainable development of the city. I congratulate J&K Biodiversity Council, ICLEI- Local Governments for sustainability, South Asia and UNDP for taking this unique initiative of development of City Biodiversity Index of Jammu city.

(Dheeraj Gupta) IAS

MESSAGE - COMMISSIONER / SECRETARY TO GOVERNMENT, DEPARTMENT OF FORESTS, ECOLOGY & ENVIRONMENT, J&K

सत्यमेव जयते

Sanjeev Verma,
IAS

Commissioner/ Secretary to Govt.
Department of Forests, Ecology & Environment, J&K

Message

Jammu and Kashmir Biodiversity Council, alongwith the city administration of Jammu is committed to conserve the biodiversity in the city; development of the City Biodiversity Index of Jammu is a key achievement towards our commitment to conserve the natural and biological resources of Smart City. We need to work on the recommendations rendered by ICLEI-Local Governments for Sustainability, South Asia, for each indicator and work actively to improve our score and address the gaps. This will improve biodiversity and its governance in the city, and also help to increase public participation and ownership in conservation of biodiversity of the city. Progress and monitoring of biodiversity conservation efforts, linked with corresponding individual baseline, would become much easier with the development of this Index. This will certainly help in harmonizing city planning with biodiversity conservation.

I commend J&K Biodiversity Council for this initiative and compliment ICLEI- Local Governments for Sustainability, South Asia and UNDP for developing City Biodiversity Index of Jammu, and look forward for further collaborations to help restore, protect and sustain the blue-green wealth of Jammu city.

(Sanjeev Verma)

MESSAGE - PCCF & HoFF, J&K FOREST DEPARTMENT/ CHAIRMAN, J&K BIODIVERSITY COUNCIL

Dr. Mohit Gera,
IFS

PCCF & HoFF, J&K Forest Department /
Chairman, J&K Biodiversity Council

Message

All life forms whether plants or animals provide certain goods and services which are crucial to human existence and economic activities. This is also true for biodiversity existing in densely populated cities. Local city governments therefore need to have scientific information on occurrence of all life forms in cities and need to protect them.

The City Biodiversity Index is the only Index and self-assessment tool designed specifically for monitoring and evaluating Biodiversity in cities. The Biodiversity Council has taken up the development of City Biodiversity Index of Jammu city for helping Jammu Municipal Corporation to create better governance mechanisms for supporting the conservation of biodiversity.

The Index comprises the indicators on native biodiversity, ecosystems services provided by biodiversity, governance & management of biodiversity. The objective assessment of these indicators will enable City Administrators to plan, manage & measure City's Biodiversity from time to time. This will also help to improve the biodiversity of Jammu which is being developed as a Smart City.

I would like to take this opportunity to thank ICLEI – Local Governments for Sustainability, South Asia for their invaluable assistance and financial support from UNDP. The efforts made by the officials of J&K Biodiversity Council are also acknowledged.

(Dr. Mohit Gera)

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ABBREVIATIONS

BMC	Biodiversity Management Committee
CBD	Convention on Biological Diversity
CBI	City Biodiversity Index
CBSE	Central Board of Secondary Education
C-HED	Centre for Heritage, Environment and Development
COP	Conference of the Parties
GOI	Government of India
ICSE	Indian Certificate of Secondary Education
IUCN	International Union for Conservation of Nature
J&K	Jammu and Kashmir
JDA	Jammu Development Authority
JKBOSE	Jammu and Kashmir Board of School Education
JMC	Jammu Municipal Corporation
JMR	Jammu Metropolitan Region
JSCL	Jammu Smart City Limited
LBSAP	Local Biodiversity Strategy and Action Plan
LULC	Land Use/ Land Cover
MARG	Multiple Action Research Group
MOEFCC	Ministry of Environment, Forests and Climate Change
NBSAP	National Biodiversity Strategy and Action Plan
NGO	Non-Governmental Organization
OECM	Other Effective area-based Conservation Measures
PBR	People's Biodiversity Register
PCCF	Principal Chief Conservator of Forests
SCBD	Secretariat of the Convention on Biological Diversity
SI	Singapore Index
SKUAST	Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu
STP	Sewerage Treatment Plant
UEED	Urban Environmental Engineering Department
UNDP	United Nations Development Programme
URDPFI	Urban and Regional Development Plans Formulation and Implementation
USGS	United States Geological Survey
UT	Union Territory

SECTION A: ABOUT CITY BIODIVERSITY INDEX

The Singapore Index (SI) or the City Biodiversity Index (CBI) was developed during the "9th Conference of Parties to the Convention on Biological Diversity" or CoP IX, (2008), held in Germany. After the first proposal, from 2009-2011 a series of expert workshops were conducted by the National Parks of Singapore, Secretariat of the Convention on Biological Diversity (SCBD) and the Global Partnership on Local and Subnational Action for Biodiversity together to prepare the CBI in 2009. This was followed by development of a guiding document in 2014, known as the user's manual on the Singapore on Cities' Biodiversity[1].

The CBI is a self-assessment tool for cities to evaluate and monitor the progress of their biodiversity conservation efforts against their own individual baselines. It comprises of a) the "Profile of the City", which provides background information on the city; and b) the 23 indicators that measure native biodiversity, ecosystem services provided by biodiversity, and governance and management of biodiversity based on guidelines and methodology provided in the User's Manual on the SI on Cities' Biodiversity (Rodricks, 2010). The calculation of the index needs to be done at a frequency of 5 years, in order for the city to measure their progress with regard to mainstreaming biodiversity conservation.

Jammu is one of the fastest growing cities in Northern India[2]. The population of the city has increased at a rate of 225.9% since 1981. Apart from the residents, Jammu harbours pilgrims, migrants and military forces. This population increase has led to significant changes in the built-up area from 14.90 km^2 (1972) to 20.38 km^2 (1980), 33.08 km^2 (1992) and 65.49 km^2 (2011)[2] necessitating the city's assessment of its natural ecosystems and biodiversity.

This 2021 application of the CBI of Jammu has been done by ICLEI- Local Governments for Sustainability, South Asia as part of the UNDP-MOEFCC- GOI supported SECURE Himalaya project. This report will act as a baseline for future monitoring and assessment of biodiversity.

Summary of the Scores

The CBI of Jammu, 2021 has been prepared based on the SCBD endorsed user's manual for CBI updated in 2014[3]. The 23 indicators that make up the index are grouped into three main components viz. Native Biodiversity, Ecosystem Services provided by biodiversity and Governance and Management of biodiversity.

The city scored a total of 40 out 72 for 18 indicators. Since this was the baseline year the indicators 4-8 were not considered for the analysis.

- The first section on "Native Biodiversity in the City", contributed to a score of 11 out of 20 as only 5 indicators were taken into consideration. The city scores average in this section, indicating that its natural ecosystems and native biodiversity are being impacted by urbanisation.
- Indicators 11-14 which relate to "Ecosystem Services Provided by Biodiversity in the City" scored 8 out of 16 points. The city scores average here again, which indicates that the health of its ecosystems needs to be improved.
- Indicators 15-23 which correspond to "Governance and Management of Biodiversity in the City" contributed to a score of 21 out of 36 points. This is a fair score, indicating that there are some governance mechanisms already in place that may benefit biodiversity and local ecosystems.

Table 1: The City Biodiversity Index of Jammu at a glance

Sl. No.	Index Category	Number of Indicators Assessed	Score
1	Native Biodiversity	5 out of 10	11 out of 20
2	Ecosystem Services	4 out of 4	8 out of 16
3	Governance and Management	9 out of 10	21 out of 36

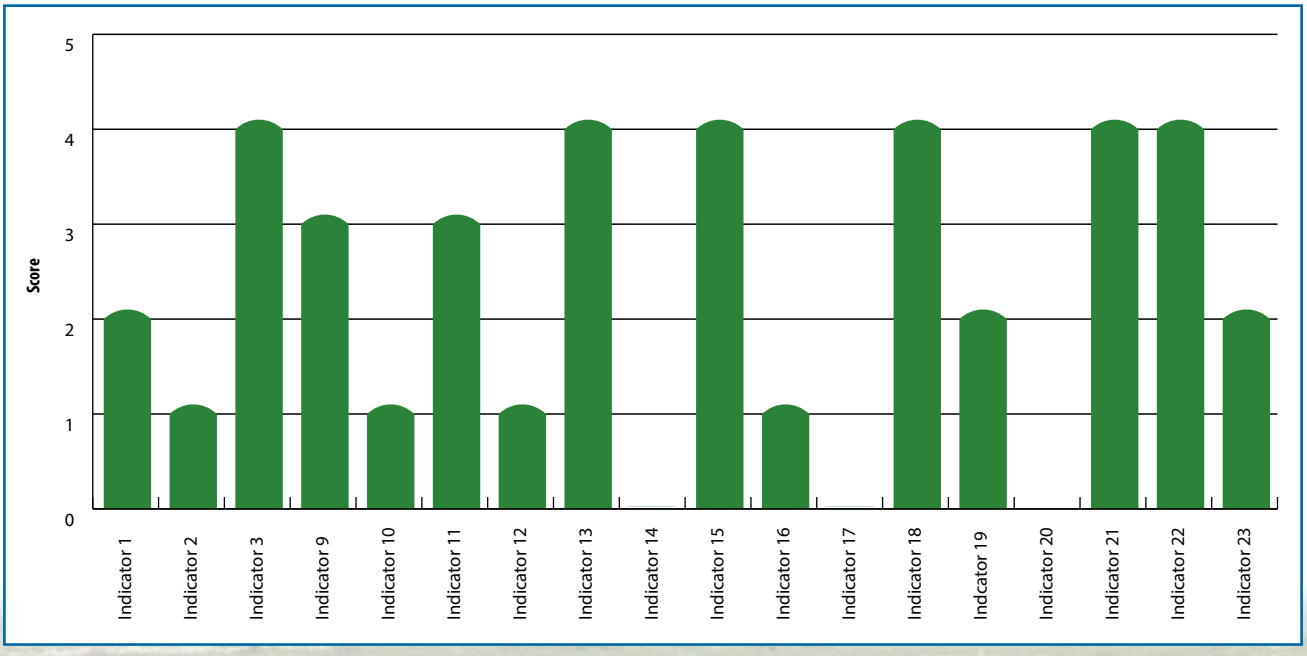


Figure 1: Jammu City Biodiversity Index 2021 at a Glance

SECTION B: CITY BIODIVERSITY INDEX OF JAMMU

Part A: City Profile

Location

Jammu city is the winter capital of the Union Territory (UT) of Jammu and Kashmir. The city lies at the coordinates of 32° 44' 9 N latitude and 74° 52' 9 E longitude.[4] Jammu is located at a lower elevation of 326 meters, in comparison with other towns and cities of the UT of Jammu and Kashmir. It is spread over an approximate area of 145.47 sq.km and is divided into 75 wards.[5] Jammu city experiences extremely hot summers and cold winters.[6] The city is characterized of possessing a humid subtropical climate. Average daily temperature recorded in the months of May, June and July range between 24.9°C and 41.7°C, whereas January is regarded as the coldest month with temperature falling to 1.3°C.[3] The southwest monsoon brings an adequate amount of rainfall in the city during the months of June to September with an annual average of 1,246 mm.

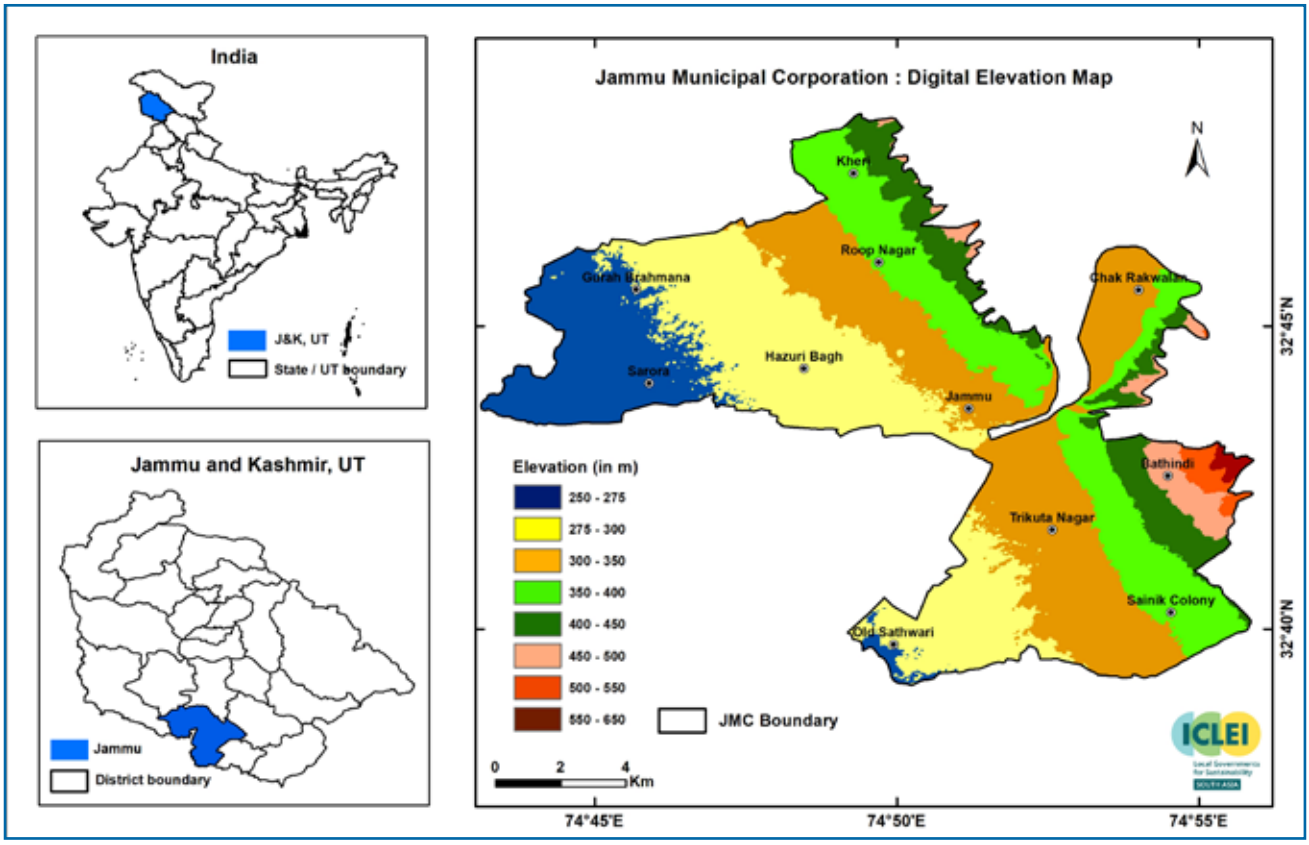


Figure 2: Location of Jammu City

Geophysical Characteristics

Jammu city, the headquarters of the Jammu district, is positioned on an undulating terrain in the Sub-Himalayan region which is divided into two parts namely, the Outer Plains and the Outer Hills of Shivaliks[6]. River Tawi bisects the city of Jammu into Heritage Old City, developed at the right bank of the river and the new city, situated at the left bank of the river. The Outer Plains have an average altitude of 340m and are characterized by water-deficient soils[6]. The areas of the Jammu city mostly on the left bank of the river and those which fall within the Kandi belt are constituted in the region of the Outer Plains. The Outer Hills of Shivaliks, also known as the foot hills of Himalaya, enclose the city boundary at the north-east and south-east sides. These hills typically have subtle slope, covered with rocks and stones. Most of the areas that fall within the right bank of the River Tawi lie at these hills of Shivaliks.

Both the Outer Plains and the Shivalik foot hills possess a peculiar topographical feature known as khads[6]. Khads are seasonal in nature and are ravines and gullies that run through these two geographic units. Khads, mainly the- Gair Mumkin Khad, also constitute the major drainage channels of Jammu and provide protection against flash floods in the city.

Demography

As per the Census of India 2011, the city of Jammu has a total population of 502,197[7]. About 53 percent of the total city population is represented by males whereas females constitute about 47 percent of the total population. Average literacy rate of the city of Jammu is approximately 90 percent. The total population of the urban agglomeration, Jammu Metropolitan Region (JMR) is 657,314. The city of Jammu contributes to 64 percent of the total urban population of the region and is therefore, designated as a primate city since 2011[7]. In addition, Jammu district has the second highest urban population after Srinagar in the UT of Jammu and Kashmir. The city of Jammu is also home to a large Kashmiri Hindu population.

In contrast to its administrative counterpart i.e. the city of Srinagar[8], Jammu city, has a majority Hindu population (81.19 percent)[7]. Sikhs constitute 8.83 percent of the city population, followed by Muslims (7.95 percent), Christians (1.35 percent), Jains (0.33 percent) and Buddhists (0.05 percent).

Economy

Jammu city is the main economic hub of the administrative division of Jammu[6]. The city is popularly referred to as the 'city of temples'. The city of Jammu reflects a vast cultural heritage with the existence of old historical buildings viz. Bahu Fort, Amar Mahal and Mubarak Mandi Palace. The city is also well-known for the production of high-quality Basmati rice in Ranbir Singh Pura area, situated at a close proximity to the city. Owing to the presence of major holy shrines such as Shri Mata Vaishno Devi and Amarnath in the adjoining region, tourism is one of the most important industries in the city. As the city of Jammu is well-regarded for its regional connectivity, leading up the way to Kashmir valley and Ladakh, it is widely acclaimed as a transit city in the local area. The city houses one of the northern-most railway terminus and airport. Hence, revenue generation through tourism significantly contributes to the local economy.

Rapid urbanization and infrastructure development in the city has led to a notable increase in the size and population of the city of Jammu[6]. As a result, adjoining villages of both Jammu and Samba districts have been enveloped within the municipal limits of Jammu city. Although relevant data regarding the city's economy is absent, as per Census 2011, about 7% of the workforce of Jammu city comprises of cultivators and agricultural labourers. Tertiary sector-based employment such as government/private jobs and businesses also contribute to the overall economy of the city of Jammu and adjoining areas. Jammu has a limited presence of industries with small-scale industries located in Gangyal and Bari Brahmana.

Biodiversity

The city of Jammu has abundance of natural resources in the form of forest at hill slopes, River Tawi, orchards and agricultural farms.[6] The city is located in the tropical climate zone and an interspersed trail of forests running from north-eastern side to the south-eastern side of the city forms an important component of the local vegetation.

Although inventory of both flora and fauna has been well-documented for various lakes, National Parks and Wildlife Sanctuaries that come under the jurisdiction of UT of Jammu and Kashmir, a complete biodiversity profile for the city of Jammu is absent. However, to provide a glimpse of the flora and fauna inhabiting the city of Jammu, a brief description is mentioned below.

Flora: A total of 304 species of vascular plants is found in the city of Jammu[9–11]. Some of the fruit-bearing, cultivated tree species found in the city of Jammu include *Mangifera indica* (Mango), *Litchi chinensis* (Litchi), *Psidium guajava* (Guava), *Vitis vinifera* (Grapes), *Emblica officinalis* (Amla), *Citrus sinensis* (Sweet Orange), *Citrus limon* (Lemon), *Prunus persica* (Peach), *Carica papaya* (Papaya), *Malus domestica* (Apple), *Fragaria ananassa* (Strawberry) and *Punica granatum* (Pomegranate). Other deciduous tree species found in Jammu city include *Terminalia chebula*, *Terminalia bellirica*, *Eucalyptus grandis*, *Albizia lebbeck*, *Toona ciliata*, *Populus ciliata*, *Dalbergia sissoo*, *Mallotus philippensis*, *Butea monosperma*, *Dodonaea viscosa*, *Vachellia nilotica*, *Tectona grandis* and *Senegalia catechu*.

The city of Jammu has a total number of 68 invasive plant species[10, 11]. A few of them include, *Acacia farnesia, Ageratum conyzoides, Amaranthus viridis, Anagallis arvensis, Bidens pilosa, Canna indica, Cassia tora, Ipomoea cylindrica, Ipomoea carnea, Lantana camara, Opuntia stricta* and *Solanum nigrum*.

The city also has planted magnolias viz. *Magnolia liliiflora*, *Magnolia soulangeana*, mostly found in avenue plantations and in parks and gardens[12].

Fauna: The city of Jammu has rich faunal diversity. A total of 220 bird species have been recorded in the city of Jammu[13–16]. Some of the birds found in the city region include waterfowls such as *Dendrocygna javanica* (Lesser Whistling-duck) and *Tadorna ferruginea* (Ruddy Shelduck), pigeons and doves such as, *Columba livia* (Rock Pigeon) and *Streptopelia chinensis* (Spotted Dove), cuckoos such as *Centropus sinensis* (Greater Coucal) and *Cuculus canorus* (Common Cuckoo), shorebirds such as *Burhinus indicus* (Indian Thick-knee), *Vanellus vanellus* (Northern Lapwing) and *Calidris pugnax* (Ruff) and herons such as *Ardea cinerea* (Grey Heron), *Ardea purpurea* (Purple Heron) and allies such as, and *Bubulcus ibis* (Cattle Egret).

A number of mammals found in the city of Jammu include *Pipistrellus paterculus* (Mount Popa Pipistrelle), *Hyaena hyaena* (Striped Hyena), *Rattus tanezumi* (Tanezumi Rat), *Tatera indica* (Indian Gerbil) and *Scotozous dormeri* (Dormer's Bat)[17–19].

There are about 85 species of butterflies found in the city of Jammu[20–22]. Some of them include *Hasora chromus* (Common Banded Awl), *Spialia galba* (Indian Grizzled Skipper), *Erionota torus* (Banana Skipper) and *Parnara bada* (Ceylon Swift).

Additionally, a number of reptiles found in the city of Jammu include *Hemidactylus brookii* (Brook's House Gecko), *Calotes versicolor* (Indian Garden Lizard), *Mabuya dissimilis* (Striped Grass Skink), *Varanus bengalensis* (Indian Monitor Lizard), *Eryx Johnii* (Earth Boa), *Bungarus caeruleus* (Common Krait) and *Naja naja* (Common Indian Cobra)[23].

Natural Asset Map: The natural asset map of Jammu city (area under the jurisdiction of JMC) has been developed by ICLEI South Asia (Figure 3). Table 2 provides details of each land class.

Table 2: Area wise distribution of natural assets of Jammu city

S.No.	Land Class	Area (In ha)
1	Open ground	192.98
2	Park/ Garden	169.61
3	Golf course	95.26
4	Avenue tree cover	171.85
5	Paddy Cultivation	3694.80
6	Terrace cultivation	45.88
7	Mixed cultivation	295.76
8	Agroforestry plantation	117.26
9	Orchard	130.60
10	Vegetable cultivation	51.85
11	Marshes	13.79
12	Sparse vegetation	543.58
13	Pond/Water body	10.60
14	River	239.30
15	Riverine vegetation / River bank	302.30
16	Flood Channel /Irrigation canal	9.00
17	Graveyard	8.89
18	Scrub forest	227.45
19	Forest / Natural vegetation	413.00
	Total	**6733.76**

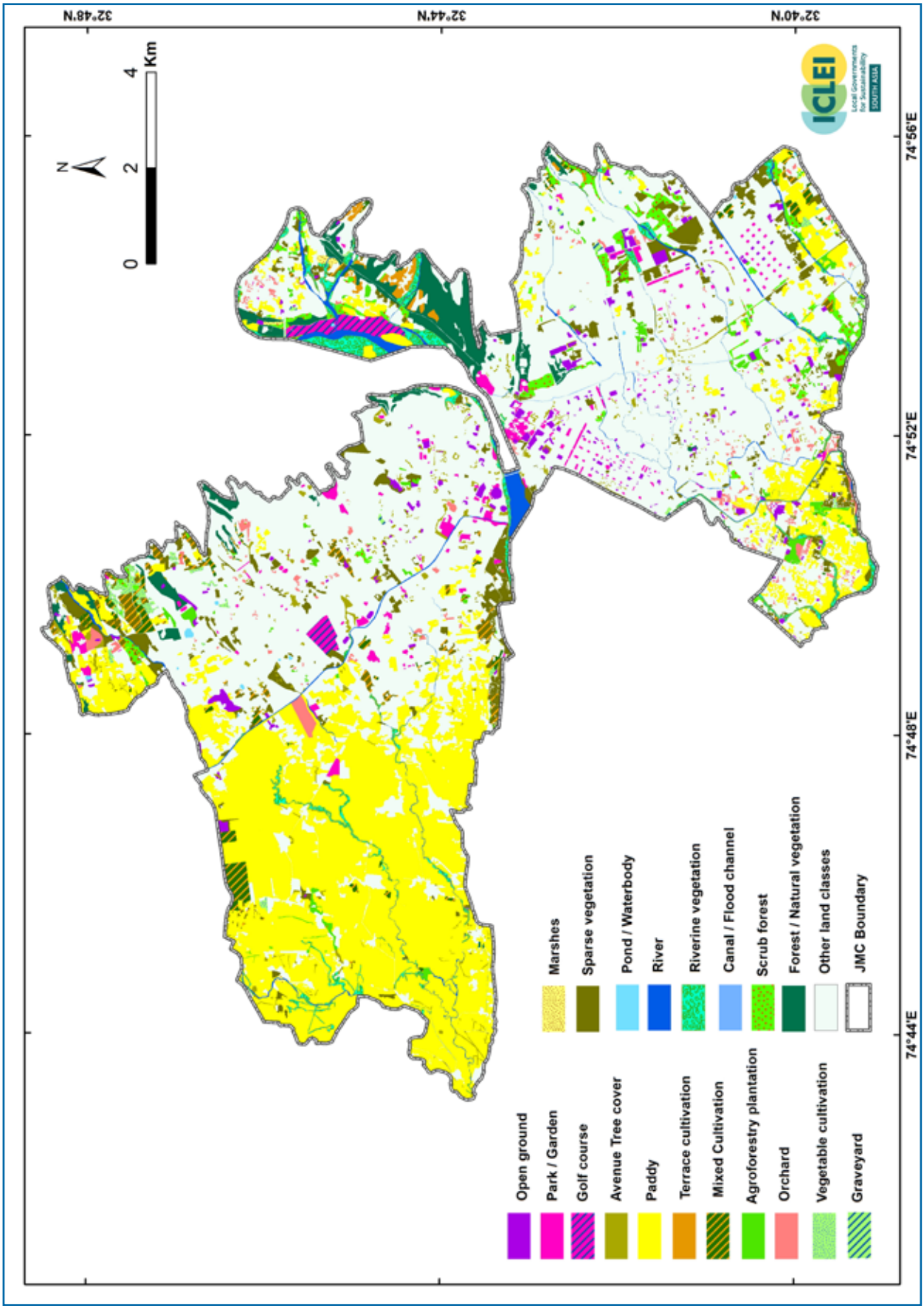


Figure 3: Natural Asset Map of Jammu City

Administration of Biodiversity

In the city of Jammu, biodiversity is administered by the following territorial and city level agencies.

Jammu and Kashmir Forest Department: This department headed by the Principal Chief Conservator of Forests (PCCF) deals with the protection, management and conservation of forests in the UT of Jammu and Kashmir. Under the East circle of Jammu region, the department is responsible for the management of forests falling under the jurisdiction of city of Jammu. For more information, please visit: http://www.jkforest.gov.in/

Urban Environmental Engineering Department (UEED): Jammu and Kashmir UEED is responsible for undertaking the works of construction of sewerage and drainage as well as the protection of environment against natural disasters and anthropogenic pressure in the urban areas of the UT including the city of Jammu. The UEED is also concerned with the construction of sewerage treatment plants (STPs) to ensure flow of treated and unpolluted water into the local water bodies. For more information, please visit: http://jkhudd.gov.in/ueedcontent.html

Jammu and Kashmir Biodiversity Council: The Government of Jammu and Kashmir set up a biodiversity council to document the biodiversity of the UT. The biodiversity council which functions in consultation with National Biodiversity Authority is headed by the PCCF of the UT, comprising a total of ten members. The council will maintain a People's Biodiversity Register (PBR) in every Panchayat and Municipal Council/ Corporaton of the UT of Jammu and Kashmir.

Jammu Municipal Corporation (JMC): JMC is mandated to carry out multiple functions and duties within the municipal limits of Jammu city. These functions include health and sanitation, sewage disposal and drainage, water supply, urban planning, development of parks and green spaces and revenue. For more information, please visit: https://www.jmcjammu.org/

Jammu Development Authority (JDA): The Authority is responsible for the preparation and implementation of Master Plan in the city of Jammu. The Master Plan envisions the sustainable development of the city of Jammu and includes environmental and suitable ecological development as one of its planning principles. The Master Plan also lays emphasis on the conservation of forests, rivers and lakes existing in the city. For more information, please visit: http://www.jda.jk.gov.in/

Jammu Smart City Limited (JSCL): This city agency aims to transform Jammu into a "sustainable and economically vibrant city focusing on tourism, quality of life and trade by leveraging its heritage and location". One of the main objectives of the Smart City Mission in Jammu includes environmental sustainability by promoting rainwater harvesting, use of solar energy, development of parks and increasing green cover. For more information, please visit: https://www.jmcjammu.org/smartcity.aspx

Jammu Biodiversity Management Committee (BMC): Biodiversity Management Committees were created to promote the conservation, sustainable use of natural resources and documentation of biological diversity. The committee is formed at the local level and is mandated as per the Biological Diversity Act, 2002. The BMC of Jammu comprises of six members, who are subject matter experts (Table 3). One of the main roles of the BMC is to develop the People's Biodiversity Register (PBR). The same has been developed for Jammu.

Table 3: Members of Jammu BMC

Sl. No.	Name	Designation	Expertise
1	Shri Sat Paul Karlupia	Chairperson	Agriculture
2	Shri Anil Kumar Masoon	Committee Member	Fisheries Trade
3	Dr. Meenakshi Khajuria	Committee Member	Environmental Science
4	Shri K. K. Sharma	Committee Member	Floriculture
5	Dr. Mohd. Saleem	Committee Member	Medicinal and Aromatic Plants
6	Smt. Tripta Jamwal	Committee Member	Social Worker

Part B: Indicators of the Singapore Index on Cities' Biodiversity

Native Biodiversity

Indicator 1: Proportion of Natural Areas in the City

As defined by the Singapore Index Manual, "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 actions are intended to conserve, enhance or restore native biodiversity."

Methodology

As per the CBI user manual

Principle for calculation of the indicator
(Total area of natural, restored and naturalised areas) ÷ (Total area of city) × 100%

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

City Data and Calculations
The proportion of natural areas for the city of Jammu was calculated by preparing a Natural Asset Map (Figure 3) which highlights natural ecosystems like forests, rivers, wetlands and modified land uses such as paddy fields, avenues, plantations, parks, playgrounds, cultivated areas. The definition of natural areas in the Singapore Index manual is difficult to strictly apply within the context of Jammu (as well as most Indian cities) where ground realities are significantly different. Income inequality, a high population density, and limited infrastructural outreach means that while there are native and natural ecosystems, they are still subject to human activity/presence or are impacted by management practices within or around their boundaries.

Table 4 shows the various natural classes that have been identified in the natural asset map of Jammu that apply to the calculation of this indicator. Anthropogenically created land classes such as Open ground, Park/ Gardens, Golf course, Avenue tree cover, Paddy Cultivation, Terrace cultivation, Mixed cultivation, Agroforestry plantation, Orchard, Vegetable cultivation, Flood Channel /Irrigation canal and Graveyard were not considered.

Table 4: Natural assets used in the calculation of indicator 1 (inside JMC boundary)

Sl. No.	Natural Assest Class	Area in sq. m.
1	Marshes	0.14
2	Sparse vegetation	5.44
3	Pond/Water body	0.11

Sl. No.	Natural Assest Class	Area in sq. m.
4	River	2.39
5	Riverine vegetation / River bank	3.02
6	Scrub forest	2.27
7	Forest / Natural vegetation	4.13
	Total	**17.50**

Indicator 1 = (Total area of natural, restored and naturalised areas) ÷ (Total area of city) × 100%

Total area of natural, restored and naturalised areas = 17.5 sq. km. (calculations include the total area of the river and other water bodies within the city limits)

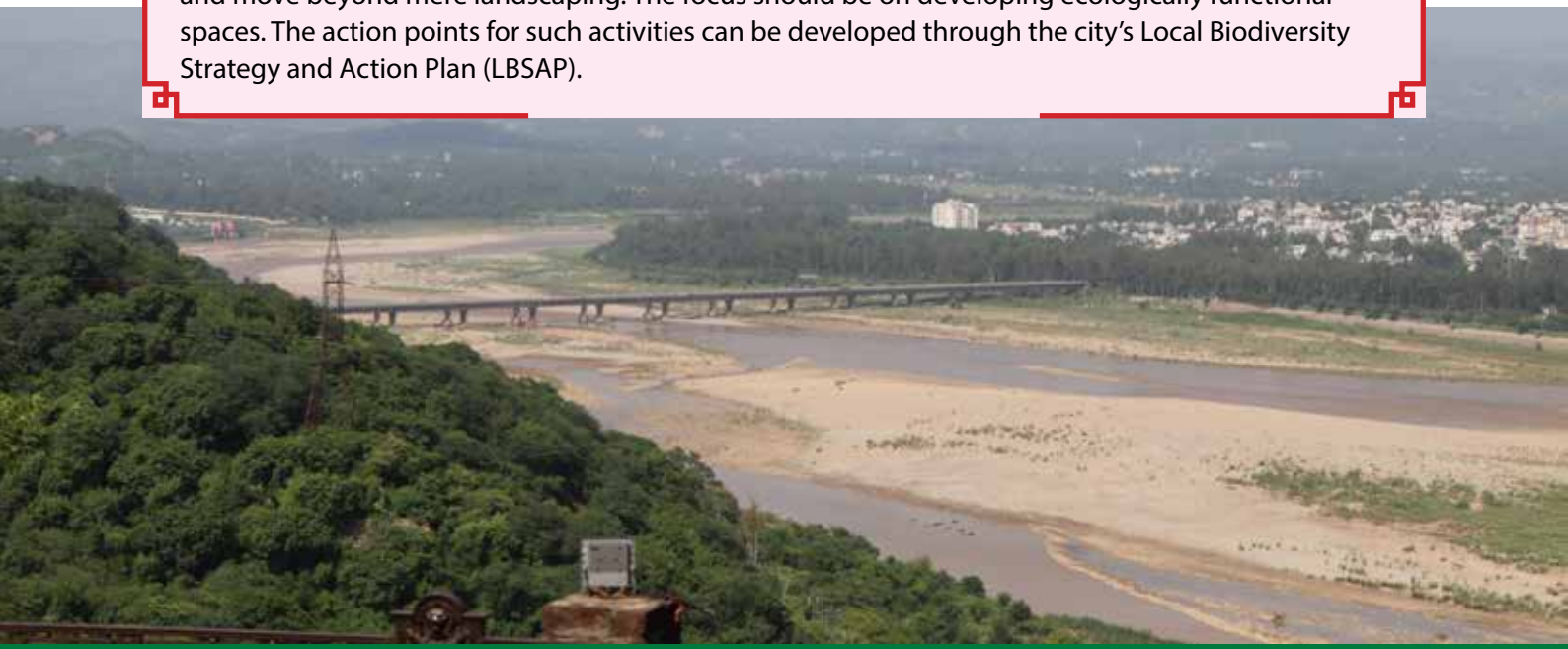
Total area of the city = 145.47 sq. km.

RESULT: 12.02%

SCORE: 2

Recommendations to Improve Score

Jammu's natural ecosystems are primarily represented by River Tawi, its hilly scrub forests, forests, and its wetlands. Already a part of these have been replaced by built-up areas, the remnant parts of the city's ecosystems are threatened by anthropogenic activities. Sand and gravel mining is common in River Tawi and the city's wetlands are challenged with pollution, and forests are facing denudation due to anthropogenic pressures. Jammu's urban green spaces are replete with ornamental plants or invasive alien species. To improve this score, the city needs to look into devising appropriate strategies that will target the improvement of these ecosystems. Although there are plans for riverfront development, these should take place with scientific inputs, leading to ecological restoration, especially of the river banks. The city must look into ecosystem restoration and move beyond mere landscaping. The focus should be on developing ecologically functional spaces. The action points for such activities can be developed through the city's Local Biodiversity Strategy and Action Plan (LBSAP).



Indicator 2: Connectivity Measures or Ecological Networks to Counter Fragmentation

Methodology

As per the CBI user manual

Principle for calculation of the indicator

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

Where:

- A_{total} is the total area of all natural areas
- A_1 to A_n are areas that are distinct from each other (i.e. more than or equal to 100m apart)
- $_n$ is the total number of connected natural areas

This measures effective mesh size of the natural areas in the city. A_1 to A_n may consist of areas that are the sum of two or more smaller patches which are connected. In general, patches are considered as connected if they are less than 100m apart.

Scoring Range: (based on the CBI user manual)

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

City Data and Calculations

The patches associated with the land classes used to calculate indicator 1, i.e., Marshes, Sparse vegetation, Pond/Water body, River, Riverine vegetation / River bank, Scrub forest, Forest / Natural vegetation, have been considered in this calculation. In reality, modified landscapes represented by the land classes- Park/ Gardens, Avenue tree cover, Paddy cultivation, Terrace cultivation, Mixed cultivation, Agroforestry plantation, Orchard, Vegetable cultivation, Flood channel /Irrigation canals also form a part of the ecological network to counter fragmentation for several species. However, these have not been considered, following the guidelines of the CBI manual.

201 polygons (patches) of the northern part and 282 polygons of the southern part were merged with the river and considered as two patch units, Patch - A_1 and Patch A_3 respectively as per the 100 m proximity rule. Therefore, the total area of this big patch - A_1 and Patch A_2 were determined as 737.30 ha and 489.88 ha respectively (Annexure 1, Table 8).

There were 401 polygons (patches) which are outside the 100m buffer of these big patches. As per the 100m proximity rule, these 401 patches are inter-merged into 136 patches (A_3 – A_{138}).

A_{total} = 1751.50 ha

As per the final calculation

Indicator 2 = 1/1751.50 ha x (805827.25 ha^2) = 460.08 ha

RESULT: 460.08 ha

SCORE: 1

Recommendations to Improve Score

Jammu scores low in this indicator because of the amount of fragmentation of its natural ecosystems. This has happened due to the increase in the built-up areas. To improve this score, the city must focus on developing an ecologically functional blue-green network which can connect the remnant patches of natural ecosystems already present. Through the LBSAP, the city can identify actions that will result in this outcome.

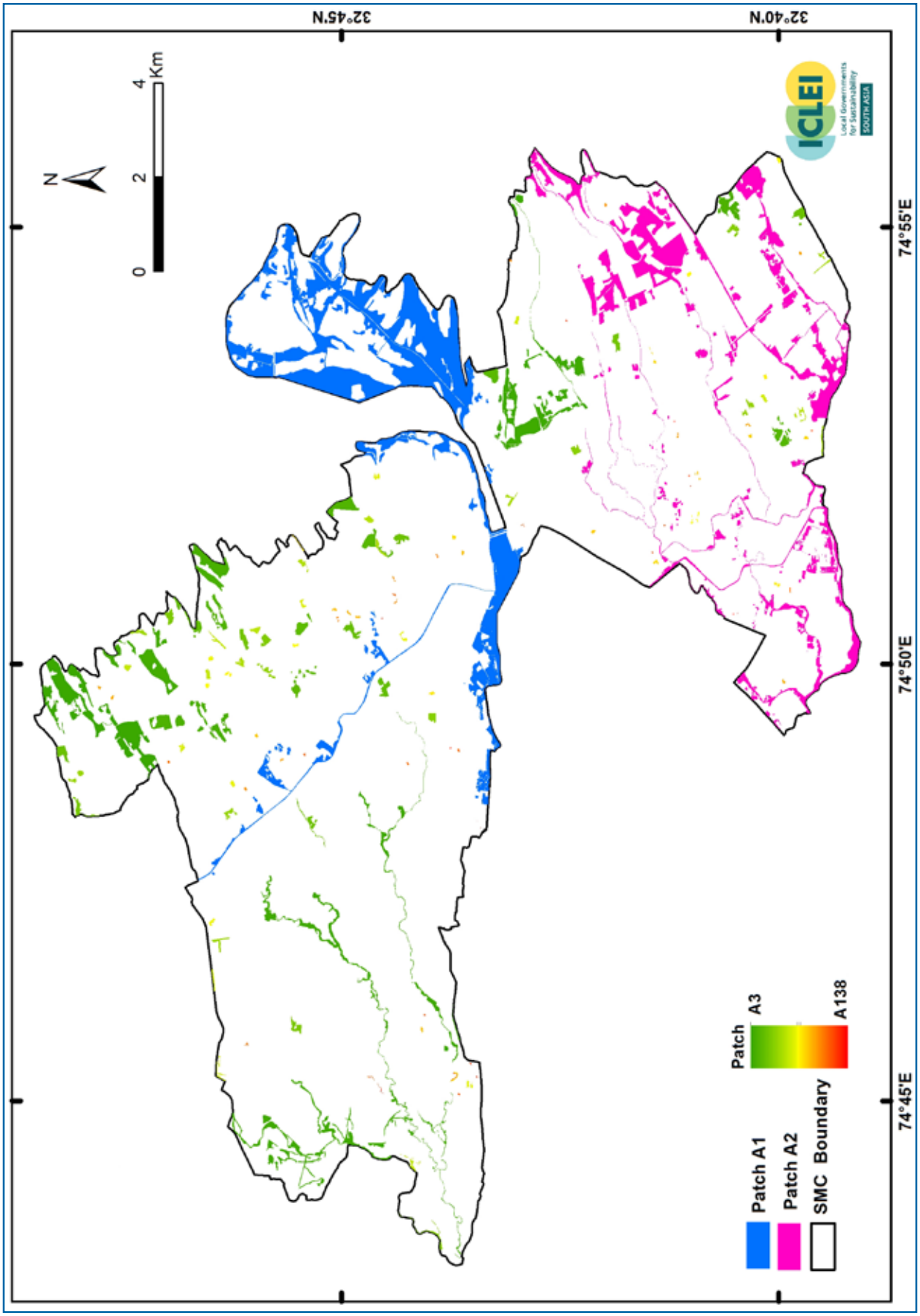


Figure 4: Connectivity map of Jammu city

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

Methodology

How to calculate indicator

Number of native bird species in built up areas where built up areas include impermeable surfaces like buildings, roads, drainage channels, etc., and anthropogenic green spaces like roof gardens, roadside planting, golf courses, private gardens, cemeteries, lawns, urban parks, etc. Areas that are counted as natural areas in indicator 1 should not be included in this indicator.

Scoring Range: (based on the CBI user manual)

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

City Data and Calculations

For the purpose of calculating Indicator 3, sightings recorded on the citizen's science platform developed by Cornell Lab of Ornithology, eBird (2021) were used to collect the necessary data. A preliminary checklist was developed at the beginning. The list was then categorized into Residents, Passage Migrants, Winter Migrants, Summer Migrants, & Vagrants. For the calculation of the present indicator resident birds sighted within the municipal corporation limits were only considered. Sightings from those areas considered in indicator 1 were not taken into account for the calculation of this indicator. This type of exclusion of sightings is possible using e-bird's mapping tools. Furthermore, the list was also checked for birds occupying modified habitats by experts including Mr. Parvez Shagoo from the Jammu and Kashmir Forest Department. The list of butterfly species was validated by Dr. Aijaz Ahmed Qureshi, Islamic University of Science and Technology and Ms. Sobiya Syeed, Commission Member, IUCN, Butterfly Moth and Specialist Group.

Of the 244 bird species that were recorded from the city, 109 species are resident species, of which 102 occur within anthropogenically altered spaces of the city. The list of the birds considered for calculation of this indicator is provided in Annexure 2, Table 9.

RESULT: 102 Species

SCORE: 4

Recommendations to Maintain Score

Bird diversity within the city is supported by habitats which are both natural and anthropogenically modified such as the river, wetlands, parks, forests, hills, institutional areas, and agricultural areas. Protected areas too, found within the city are important habitats for many bird species. In order to sustain this score, the city needs to ensure the maintenance of these spaces which provide a variety of resources for birds of the city. An action plan for the same can be developed through the LBSAP of the city.

Indicators 4 - 8: Change in Number of Native Species

Methodology

How to calculate indicator

The change in number of native species is used for indicators 4 to 8. The three core groups are:

- Indicator 4 : vascular plants
- Indicator 5 : birds
- Indicator 6 : butterflies

These groups have been selected as data are most easily available and to enable some common comparison.

Cities can select any two other taxonomic groups for indicators 7 and 8 (e.g. bryophytes, fungi, amphibians, reptiles, freshwater fish, molluscs, dragonflies, beetles, spiders, hard corals, marine fish, seagrasses, sponges, etc.)

The above data from the first application of the Singapore Index would be recorded in Part I: Profile of the City as the baseline.

Net change in species from the previous survey to the most recent survey is calculated as:

Total increase in number of species (as a result of re-introduction, rediscovery, new species found, etc.) minus number of species that have gone extinct.

Scoring Range: (based on the CBI user manual)

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

City Data and Calculations

Information on the required species details was only available in the People's Biodiversity Register of Jammu city, which was shared by the Jammu and Kashmir Biodiversity Council. The rest of the data was gathered using online citizen science databases, online or offline research articles and anecdotal resources. Bird data was gathered from the citizen's science platform developed by Cornell Lab of Ornithology, eBird (2021), list of butterflies was prepared from Sheikh et al. (2019; 2021) and Sharma and Sharma (2017). Checklist of mammals was prepared as per the distribution data of IUCN (https://www.iucnredlist.org/resources/spatial-data-download, 2019), and reptile data was gathered after Manhas et al (2016). After preparation of the preliminary lists, they were circulated among taxa experts from the city to validate the data.

Information on indicator 4 was sourced from the People's Biodiversity Register (2020), Kour et al. (2014) and Gupta (2018) in order to arrive at the final result for this taxon (Annexure 2, Table 10).

The checklists for indicator 5 (birds) (Annexure 2, Table 9), indicator 6 (butterflies) (Annexure 2, Table 11), and indicator 8 (mammals) (Annexure 2, Table 12) were validated by Mr. Parvez Shagoo, J&K Forest Department, Dr. Aijaz Qureshi, Islamic University of Science and Technology, Dr. Khursheed Ahmad, SKUAST-Kashmir, respectively.

Since, this is the first CBI assessment of the Jammu City, indicators 4-8 will not be scored.

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

Indicator 9: Proportion of Protected Natural Areas

Methodology

How to calculate indicator
(Area of protected or secured natural areas) ÷ (Total area of the city) × 100%

Scoring Range: (based on the CBI user manual)
0 point: < 1.4%
1 point: 1.4% - 7.3%
2 points: 7.4% - 11.1%
3 points: 11.2% - 19.4%
4 points: > 19.4%

City Data and Calculations
The governance models for biodiversity in India are of five types, which fall under two main streams - State driven conservation and Community based conservation. Within Jammu city, natural areas that receive protection fall primarily under the state driven category of protected areas, i.e. Ramnagar Wildlife Sanctuary and Bahu Conservation Reserve, both of which were notified in 1981. Ramnagar Wildlife Sanctuary covers a total area of 31.50 km^2 of which only 5.01 km^2 falls within the Jammu city boundary. Bahu Conservation Reserve occupies a total area of 19.75 km^2.

Ramnagar Wildlife Sanctuary = 5.01 km^2

Bahu Conservation Reserve = 19.75 km^2

The total protected or secured natural area = 24.76 km^2

Total area of the city = 145.47 km^2

RESULT: 17.02%

SCORE: 3

Recommendations to Improve Score

Although Jammu city has scored well under this indicator it must be noted that the condition of both protected areas needs attention. Mahamaya city forest which falls under the Bahu Conservation Reserve was found to be infested with invasive species such as *Lantana camara* and *Parthenium hysterophorus*. A detailed study aimed at the estimation of the extent of spread of these invasives in the Conservation Reserve needs to be carried out.

Since the two protected areas fall under the jurisdiction of the Department of Forest, its management and maintenance too, remains with the same department. JMC through its BMC can support the Department by developing an invasive species management plan and support in the execution of the same.

Jammu also has a rich history of community-based conservation through its Baradari system, which now is almost wiped out within the city. Through this system, ponds and their associated vegetation were designated as shrines or sacred groves. Revival of these traditional conservation models through the Jammu BMC can really boost the score of the city for this indicator and support cultural practices as well. The city authorities and J&K Biodiversity Council can also look at considering declaring some of the suitable sites as Other Effective area-based Conservation Measures (OECM). The OECM categories for India have recently been finalized by the Ministry of Environment, Forest and Climate Change, Government of India.

Indicator 10: Proportion of Invasive Alien Species

Methodology

How to calculate indicator
(Number of invasive alien species) ÷ (Number of native species) × 100%

Scoring Range: (based on the CBI user manual)
0 point: > 30.0%
1 point: 20.1% - 30.0%
2 points: 11.1% - 20.0%
3 points: 1.0% - 11.0%
4 points: < 1.0%

City Data and Calculations
The definition of alien invasive species, which has been considered for this indicator in the CBI is "one whose introduction and/or spread threatens biological diversity (For the purpose of the present guiding principles, the term "invasive alien species" shall be deemed the same as "alien invasive species" in accordance with Decision V/8 of the CoP to the Convention on Biological Diversity)".

The vascular plant taxon, which is also the most well documented taxon in terms of alien species, was selected for the purpose of calculation of indicator 10. For the purpose of calculation of this indicator, the list of flowering plants of the city was compiled from the People's Biodiversity Register prepared for Jammu. This list comprises of the plants that are found across the city (Annexure 2, Table 10). The species were then classified into native and introduced species based on the available literature. [11,12] Introduced species were further refined into alien invasive species from published literature.[11,12]

Total Number of Invasive Alien Species = 67. Total Number of Native Species = 99 (Annexure 1, Table 10).
Proportion of Invasive Alien Species = (67÷ 99) × 100 = 67.67%

RESULT: 67.67%

SCORE: 0

Recommendations to Improve Score

Assessment of present indicator for Jammu shows a very high proportion of invasive species. Within a large part of the city such as road side plantations and avenues, army areas, parks and institutional areas, ornamental plants dominate along with some invasive species like *Lantana camara*, *Parthenium hysterophorus*. BMC of Jammu city should take lead and coordinate revegetating native species at such areas. City parks should also be maintained and removal of invasive species should be taken up on immediate basis, in collaboration with the Department of Floriculture, Forests and other land owning agencies. Apart from the replantation of native species and invasive species removal, local communities should also be made aware of the need for such actions, through arranging campaigns and programmes during Van Mahotsav, Green J&K Drives and other such special occasions. Documentation and awareness on adverse impacts of invasive species through Universities and NGOs is also recommended in order to map out the priority areas for such actions.

Indicator 11: Regulation of Quantity of Water

Methodology

How to calculate indicator
(Total permeable area) ÷ (Total terrestrial area of the city) × 100%

Scoring Range: (based on the CBI user manual)
0 point: < 33.1%
1 point: 33.1% - 39.7%
2 points: 39.8% - 64.2%
3 points: 64.3% - 75.0%
4 points: > 75.0%

City Data and Calculations

City-level data on permeable/non-permeable spaces was absent hence a permeability map (Figure 5) was prepared by ICLEI South Asia for the purpose of calculating this indicator. Sentinel 2A data was extracted from the Copernicus program of the European Space Agency for the analysis of the JMC Area. Land use classes of Water Body, Bare Land, Forest, Scrub Forest, Marshes, Agroforestry, Paddy and Urban built-up was considered for the classification. After the LULC classification, the respective land classes were merged and permeability map was prepared.

Table 5: Permeable and non-permeable areas in Jammu

	Area (ha)	Area (%)
Permeable land area	9785.52	67.26
Water body	38.44	0.26
Impermeable area	4724.42	32.47

Total permeable area = Permeable land area+ Water body = 9823.96 ha

Total Terrestrial area = 14509.94 ha

Regulation of Quantity of Water= (9823.96 ÷ 14509.94) × 100%

RESULT: 67.71 %

SCORE: 3

Recommendations to Improve Score

Jammu scored well for this indicator, implying that the city has enough vegetated areas for an improved rate of flow of rain water. This may be attributed to the higher proportion of agricultural lands, river and wetlands which allow water to move into the soil and act as flood receptors. Therefore, for the city to maintain and improve this score in subsequent applications of the CBI it is imperative that these ecosystems be protected against encroachment or conversion to built-up areas. Another important ecosystem to be considered is the Khads of the city. These are predominantly seasonal in nature, appearing during the monsoon period, and are extremely important for the natural drainage, safeguarding the city from flash floods. Strategies to protect these ecosystems may be identified in the LBSAP.

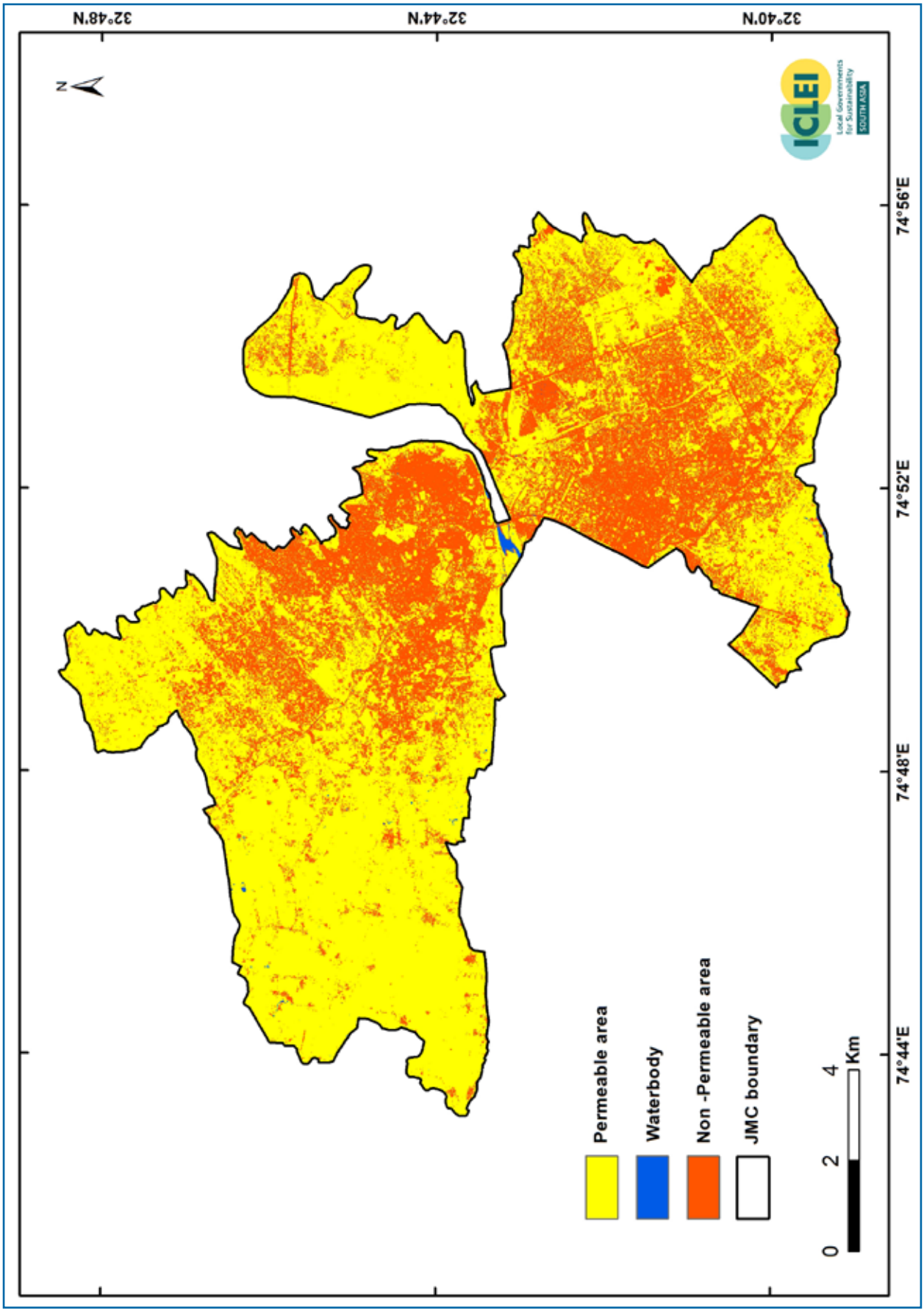


Figure 5: Map showing the area of permeability, non-permeability and waterbodies in Jammu city

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

Methodology

How to calculate indicator
(Tree canopy cover) ÷ (Total terrestrial area of the city) × 100%

Scoring Range: (based on the CBI user manual)
0 point: < 10.5%
1 point: 10.5% - 19.1%
2 points: 19.2% - 29.0%
3 points: 29.1% - 59.7%
4 points: > 59.7%

City Data and Calculations

In order to calculate this indicator, a tree cover map (Figure 6) was developed using Sentinel satellite imagery (10 m resolution). The data was extracted from the Copernicus program of the European Space Agency for the analysis of the JMC Area. Sentinel-2 Level 2 products with a cloud cover of less than 10% comprising the study region (Tile Number - T43SDT) acquired on 16 July 2020 were downloaded from USGS Earth Explorer. The final tree cover map was prepared by supervised classification of pre-processed satellite data using the spectral signature file developed from the field data.

Table 6: Estimated area of tree cover in Jammu city

Item	Area (ha)
Tree cover	1632.16
Total terrestrial area	14509.94

Tree cover = 1632.16 ha

Total terrestrial area of the city= 14509.94 ha

Carbon Storage and Cooling Effect of Vegetation= (1632.16 /14509) *100

RESULT: 11.25 %

SCORE: 1

Recommendations to Improve Score

Tree cover assessment of Jammu city shows higher proportion of coverage in the eastern sections of the city and low to moderate in the northern fringe. Rest of the city has almost negligible tree cover. To improve this indicator, the city should look into developing native tree green belts along roadsides, avenues and parks, especially along the central and southern areas of the city. Scientifically revegetating and ecologically restoring degraded areas will also boost this score. The BMC, in collaboration with JMC, J&K Biodiversity Council, J&K Forest Department and Social Forestry Division and other NGOs can play a significant role in the same.

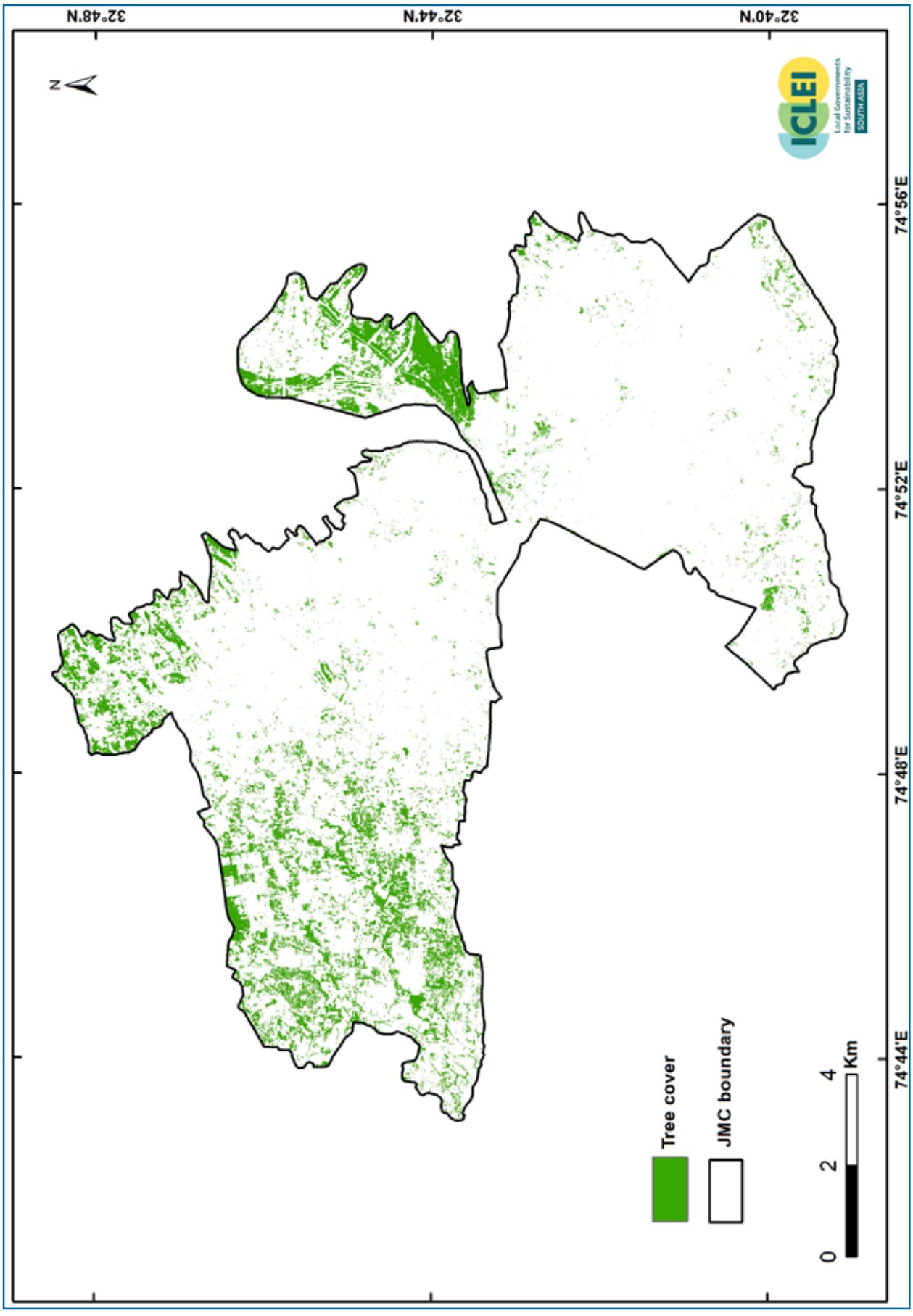


Figure 6: Tree cover map of Jammu city

Indicator 13: Recreational Services

Methodology

How to calculate indicator
(Area of parks with natural areas and protected or secured natural areas)/1000 persons

Scoring Range: (based on the CBI user manual)
0 point: < 0.1 ha/1000 persons
1 point: 0.1 - 0.3 ha/1000 persons
2 points: 0.4 - 0.6 ha/1000 persons
3 points: 0.7 - 0.9 ha/1000 persons
4 points: > 0.9 ha/1000 persons

City Data and Calculations
Data for this indicator was collected from JMC which maintains parks and recreational areas within the city jurisdiction. Some of the parks are also managed collaboratively with the Department of Floriculture, a UT agency. A total of 251 parks were found within the city of Jammu. The smallest park within the city is 0.002 hectares (a municipal park located at Kunjwani inside Mohalla, Kunjwani) while the largest is around 28.47 hectares (Bhour Camp Garden). The average size of the parks in the Jammu city is approximately 0.36 hectares. Total Park area in Jammu city is 90.55 hectares. A list of all the parks under JMC is provided in Annexure 3.

Jammu city has two Protected Areas– Ramnagar Wildlife Sanctuary and Bahu Conservation Reserve which are also used as recreational spaces. They have an area of 3,150 ha and 1,975 ha, respectively. Though the total area of Ramnagar Wildlife Sanctuary is 3150 ha, only 501 ha falls within the city jurisdiction. Therefore, the total area of the Protected Areas in Jammu city is 2476 hectare.

Total area of parks with natural areas used for recreational purposes = 90.55 ha + 2,476 ha = 2,566.5 ha

RESULT: 2.56 ha/1000 persons

SCORE: 4

Recommendations to Maintain Score

The city of Jammu has scored highest points possible for this indicator, primarily due to the presence of the two protected areas - Ramnagar Wildlife Sanctuary and Bahu Conservation Reserve. Excluding these areas from the calculation results in an area of 90.55 ha or 0.09 ha per 1000 persons, which would receive a score of 0. This is less than the minimum standard of 570 ha, as provided in the Urban and Regional Development Plans Formulation and Implementation (URDPFI, Vol. I) Guidelines, 2015.[25] The city must, on priority, establish more organised native green spaces. Partnerships with agricultural land owners resulting in them setting aside a small proportion of land which can be developed into recreational green spaces through an appropriate financial model, will not only result in protection of the city's agricultural lands from being converted, but also provide recreational spaces for locals.

Indicator 14: Educational Services

Methodology

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

Scoring Range: (based on the CBI user manual)
0 point: 0 formal educational visit/year
1 point: 1 formal educational visit/year
2 points: 2 formal educational visits/year
3 points: 3 formal educational visits/year
4 points: > 3 formal educational visits/year

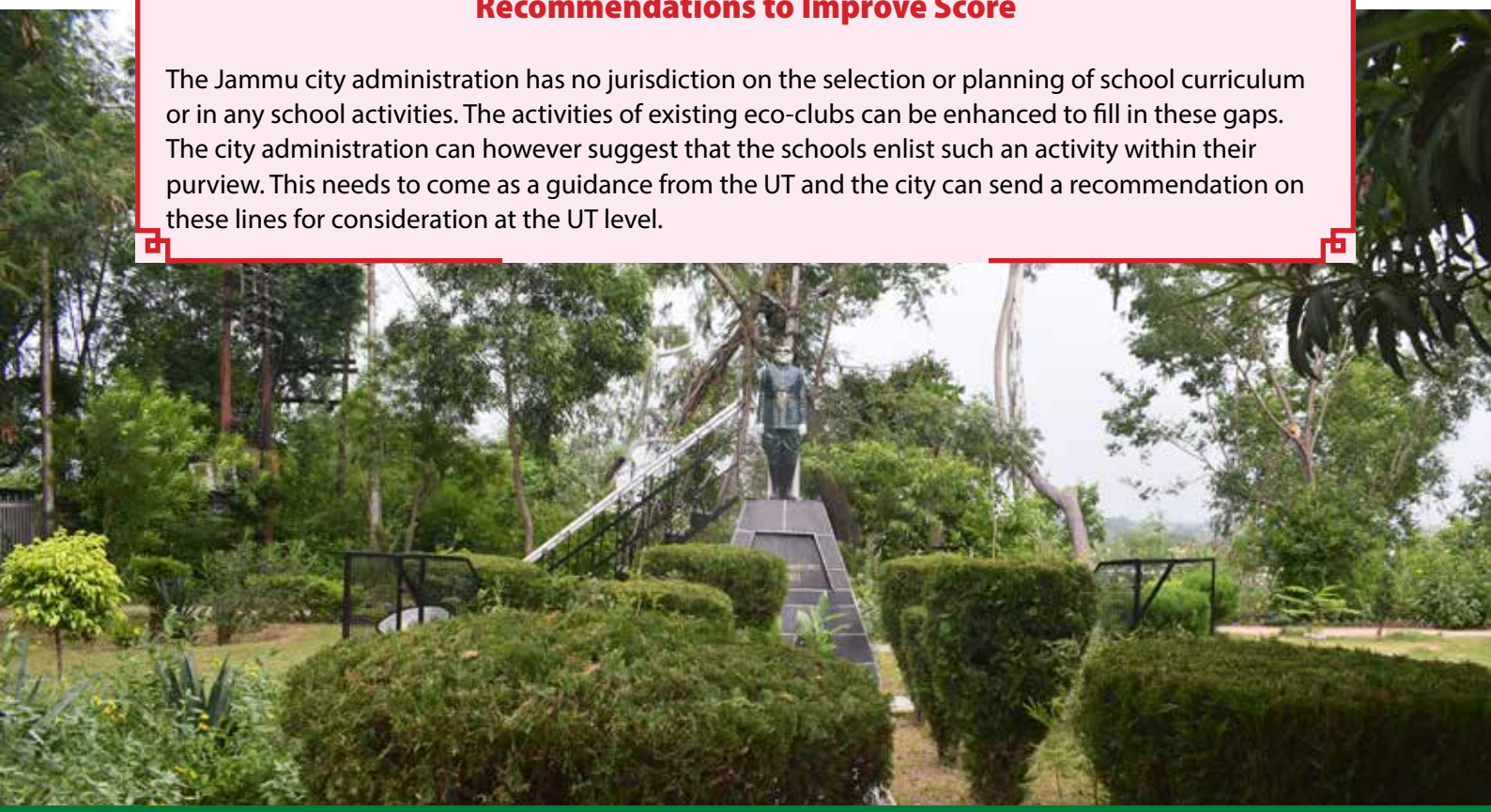
City Data and Calculations
According to the JMC no formal visits to natural areas are made by students below 16 years, studying in educational institutions. Each school decides where the excursion will take place and which class students will attend. These visits are not mandated in the school curriculum by the educational boards.

RESULT: No formal educational visit

SCORE: 0

Recommendations to Improve Score

The Jammu city administration has no jurisdiction on the selection or planning of school curriculum or in any school activities. The activities of existing eco-clubs can be enhanced to fill in these gaps. The city administration can however suggest that the schools enlist such an activity within their purview. This needs to come as a guidance from the UT and the city can send a recommendation on these lines for consideration at the UT level.



Indicator 15: Budget Allocated to Biodiversity

Methodology

How to calculate indicator
(Amount spent on biodiversity related administration) ÷ (Total budget of city) × 100%

Scoring Range: (based on the CBI user manual)
0 point: < 0.4%
1 point: 0.4% - 2.2%
2 points: 2.3% - 2.7%
3 points: 2.8% - 3.7%
4 points: > 3.7%

City Data and Calculations
The following budget allocations in the municipal budget for the financial year 2021-22 contribute to biodiversity conservation:

Management and maintenance of Parks = ₹50 million

Management and maintenance of Floriculture Parks = ₹55 million

Rejuvenation of waterbodies within JMC city limit = ₹50 million

Total allocated budget for biodiversity related administration (2021-22) = ₹155 million

Total budget for city administration (2021-22) = ₹ 2686.9 million

Budget Allocated to Biodiversity = (155/2686.9) x 100

RESULT: 5.77%

SCORE: 4

Recommendations to Maintain Score

Though the city has scored high for this indicator, biodiversity related activities that have been budgeted for are majorly concentrated on park development and maintenance. This is a small aspect of biodiversity management and does not encompass the city's natural ecosystems. The city must take up a more active role in biodiversity governance, through its LBSAP and incorporate a meaningful financial commitment in the annual municipal budget for initiatives proposed in the LBSAP.

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

Methodology

How to calculate indicator
Number of programmes and projects that are being implemented by the city authorities, possibly in partnership with private sector, NGOs, etc. per year.

In addition to submitting the total number of projects and programmes carried out, cities are encouraged to provide a listing of the projects and to categorise the list into projects that are:
1. Biodiversity related
2. Ecosystems services related

Scoring Range: (based on the CBI user manual)

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

City Data and Calculations
This indicator is calculated based on the number of biodiversity related projects and programmes that the city authorities are involved in, either as the main player or in partnership with NGOs and the private sector. Following projects or programs are related to the biodiversity and ecosystem services of the Jammu City for the year 2021-2022:

1) People's Biodiversity Register: With support from the J&K Biodiversity Council, the Biodiversity Management Committee of Jammu has developed the People's Biodiversity Register.
2) City Biodiversity Index (CBI): The CBI is being prepared by ICLEI – Local Governments for Sustainability, South Asia for the Jammu city to consolidate the available biodiversity-related local level data, which could then help to evaluate and benchmark their biodiversity conservation efforts.
3) LBSAP: ICLEI – Local Governments for Sustainability, South Asia is developing the LBSAP for the Jammu city which will provide guidance and direction to the city to sustainably manage and conserve its biodiversity.
4) Plantation and Landscaping Park Development: Five lakh saplings are being planted during 2021-22 under the Jammu Smart City Initiative. Urban Forestry wing of the Forest Department in consultation with the Department of Floriculture is involved in plantation and landscaping at various wards of the Jammu city.
5) Green J&K Drive Programme: City avenues, Government institutional lands and State Forest lands have been selected for the plantation and beautification throughout the Jammu city.
6) Bahu Fort Beautification: Jammu Development Authority has started landscaping and beautification of retrieved land adjoining the Bahu Fort. Development and maintenance of adjacent parks are also accounted for under this programme.

7) Artificial Lake & Development of Tawi River: Construction of an artificial lake is in progress by the Jammu Development Authority at Bhagwati Nagar of the City. Additionally, beautification of the riverside parks, and river cleanliness are also part under this programme.

8) Waste Management: Jammu Municipal Corporation has started the segregation and treatment of organic waste in the city in financial year 2021-2022.

9) Water Management: Jammu Municipal Corporation has started programmes on desilting of nalas within the Jammu city, new policy on the ground water extraction and have recommended permissions for rainwater recharge in city buildings.

10) Idol Immersion Policy: Jammu Municipal Corporation has initiated a new policy guideline on the idol immersions in the wetlands and river. River and wetland cleanliness programmes, after idol immersion have been included in the same.

11) Rejuvenation of Wetlands: Jammu Municipal Corporation has prepared an action plan for rejuvenation of 61 waterbodies within the city limits for the year 2021-2022. Under this plan these selected wetlands will be rejuvenated by reshaping and managing water levels, cleaning, de-siltation, bush cutting, fixing sitting benches, fencing and walkway for water body management and locals to visit as for recreational purposes.

12) Nurture Nature: Jammu Municipal Corporation has arranged a tree plantation drive from 15th July to 31st July, 2021.

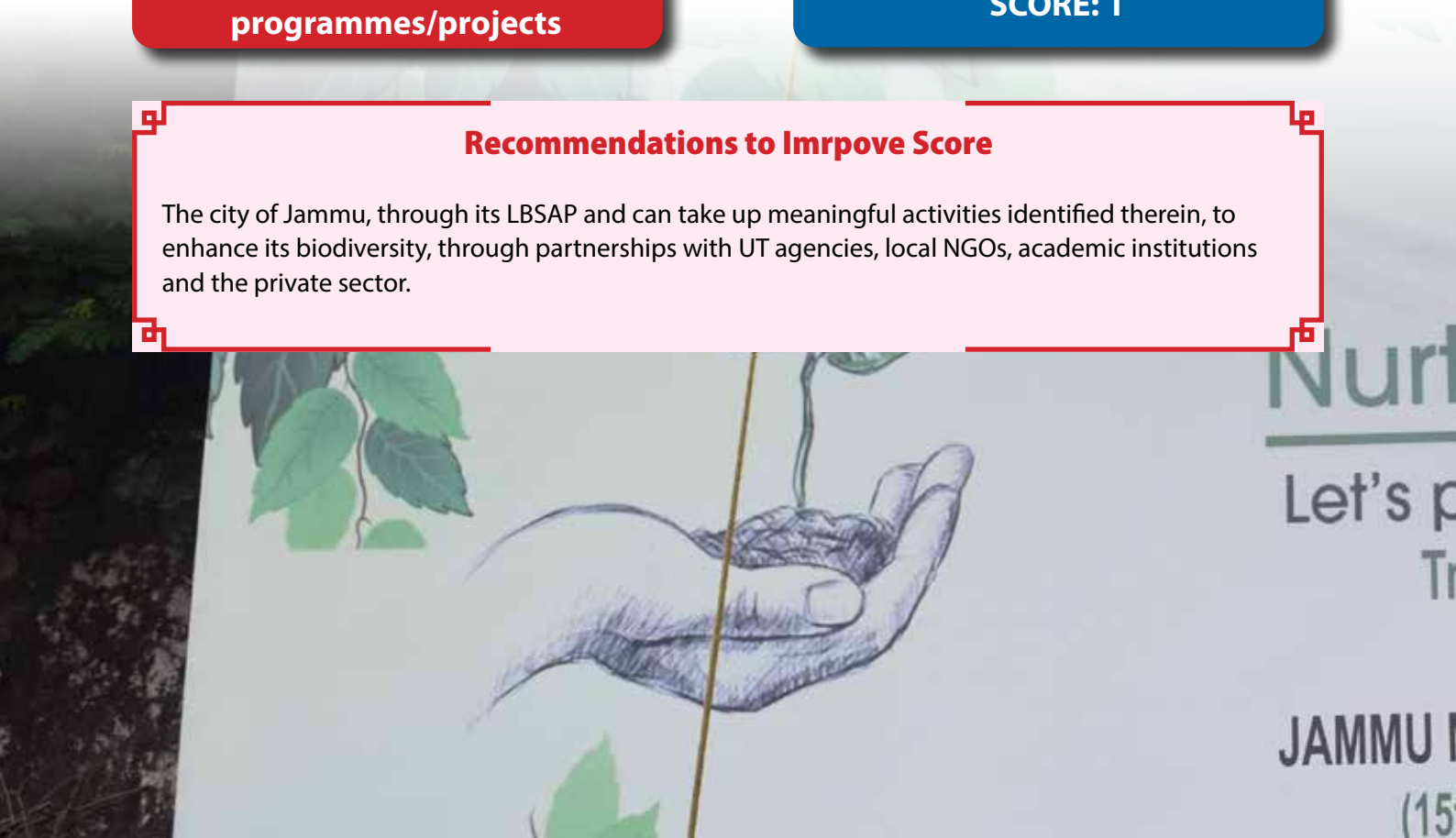
13) Stray Dog Sterilization: The Veterinary Wing of JMC carries out sterilization/immunization of stray dogs at Municipal Animal Care Centre, Roop Nagar, Jammu.

RESULT: 13 programmes/projects

SCORE: 1

Recommendations to Imrpove Score

The city of Jammu, through its LBSAP and can take up meaningful activities identified therein, to enhance its biodiversity, through partnerships with UT agencies, local NGOs, academic institutions and the private sector.



Indicator 17: Policies, Rules and Regulations – Existence of Local Biodiversity Strategy and Action Plan

Methodology

How to calculate indicator
Status of LBSAP (or any equivalent plan); number of associated CBD initiatives.

Scoring Range: (based on the CBI user manual)

0 point:	No LBSAP*
1 point:	LBSAP not aligned with NBSAP
2 points:	LBSAP incorporates elements of NBSAP, but does not include any CBD initiatives**
3 points:	LBSAP incorporates elements of NBSAP, and includes one to three CBD initiatives
4 points:	LBSAP incorporates elements of NBSAP, and includes four or more CBD initiatives

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

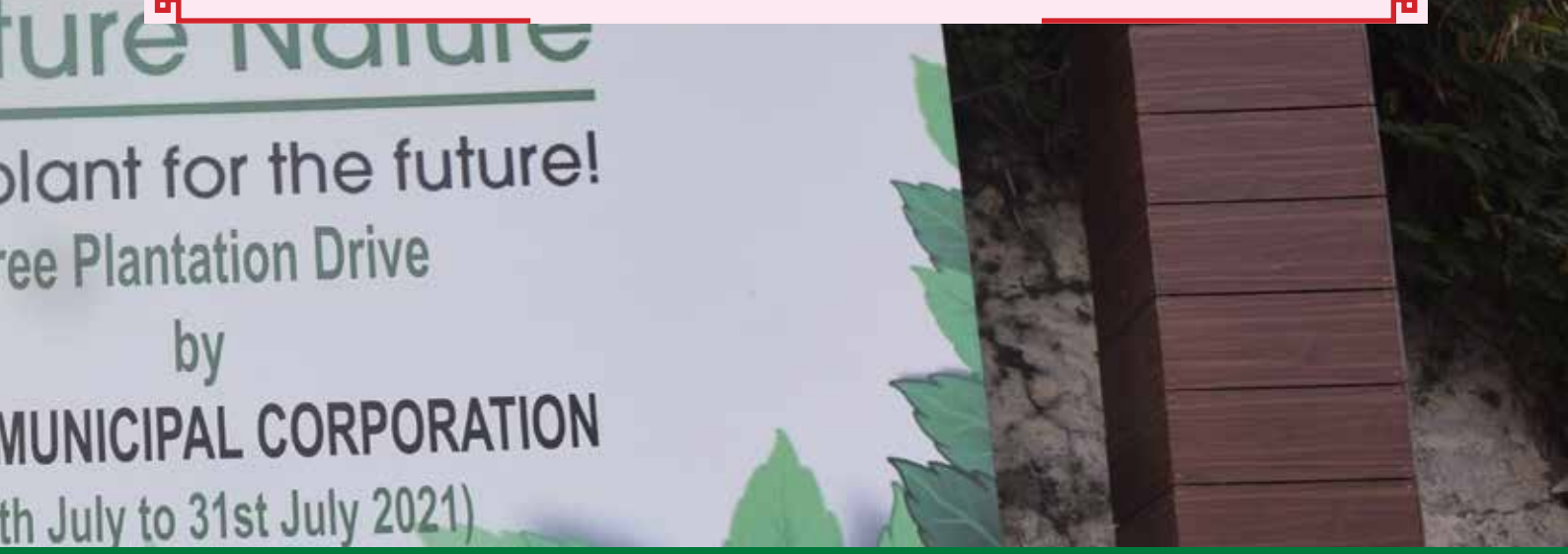
City Data and Calculations
The city does not have an LBSAP, but the same is being developed in collaboration with ICLEI-Local Governments for Sustainability, South Asia.

RESULT: No LBSAP

SCORE: 0

Recommendations to Imrpove Score

The city has already initiated the development of the LBSAP. The adoption of the LBSAP by the city council will help to improve several indicator scores as well as biodiversity governance in the city. Once the LBSAP is finalised and accepted by JMC, the various strategies outlined can be institutionalised in subsequent municipal budgets, and then implemented across the city.



Indicator 18 : Institutional Capacity - Essential Biodiversity Related Functions

Methodology

How to calculate indicator

Number of essential biodiversity related functions* that the city uses.

* The functions could include the following: biodiversity centre, botanical garden, herbarium, zoological garden or museum, insectarium, etc.

Scoring Range: (based on the CBI user manual)

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

City Data and Calculations

There are a number of essential biodiversity related functions within the city's jurisdiction which have been listed below:

- Botanical Garden at University of Jammu
- Janaki Amma Herbarium, Council of Scientific and Industrial Research at Indian Institute of Integrative Medicine
- Herbarium at Department of Botany, University of Jammu
- Insectarium at Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu
- Manda Zoo
- Tawi Herbal Park
- Herbal Gardens in various schools within the city. Some of the examples are Sri Ranbir Model High Secondary School (SRML), Government Girls Higher Secondary School, Canal Road, Jammu; Government Hari Singh Higher Secondary School, Jammu, Government Higher Secondary School, Bakshi Nagar etc.*

RESULT: 7

SCORE: 4

Recommendations to Maintain Score

The city of Jammu has scored well in this indicator. It is recommended to use these biodiversity related functions for creation of awareness and education among students. Occasional programmes and competitions arranged by these functional bodies in collaboration with schools of the city are suggested, to promote further use of these facilities. Establishment of eco clubs in schools in partnership with universities can motivate the local students and communities and can thus be facilitated by the city government and J&K Biodiversity Council.

* http://schedujammu.nic.in/herbal_garden.htm#tagjammu

Indicator 19 : Institutional Capacity - Inter-Agency Co-Operation

Methodology

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

Scoring Range: (based on the CBI user manual)
0 point: 1 or 2 agencies* cooperate on biodiversity matters
1 point: 3 agencies cooperate on biodiversity matters
2 points: 4 agencies cooperate on biodiversity matters
3 points: 5 agencies cooperate on biodiversity matters
4 points: > 5 agencies cooperate on biodiversity matters

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

City Data and Calculations
There are four main government agencies which are involved in matters pertaining to biodiversity in Jammu city. They are:

- Jammu Municipal Corporation (JMC)
- Biodiversity Management Committee (BMC)
- Jammu Development Authority (JDA)
- Jammu Smart City Limited (JSCL)

RESULT: 4

SCORE: 2

Recommendations to Improve Score

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

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

Methodology

How to calculate indicator
Existence and state of formal or informal public consultation process pertaining to biodiversity related matters.

Scoring Range: (based on the CBI user manual)

0 point:	No routine formal or informal process
1 point:	Formal or informal process being considered as part of the routine process
2 points:	Formal or informal process being planned as part of the routine process
3 points:	Formal or informal process in the process of being implemented as part of the routine process
4 points:	Formal or informal process exists as part of the routine process

City Data and Calculations
No formal or informal public consultation exists in the city with respect to biodiversity matters.

RESULT: No routine formal or informal process

SCORE: 0

Recommendations to Improve Score

The city of Jammu needs to incorporate a public consultation process for biodiversity related activities. This will also help to create greater ownership and support among the citizens for the projects and conservation of the city's natural ecosystems. The consultation outreach can be done through social media channels or through strategies developed as part of the smart city e-governance infrastructure.

Indicator 21 : Participation and Partnership - Institutional Partnership

Methodology

How to calculate indicator

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

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

Scoring Range: (based on the CBI user manual)

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

City Data and Calculations

The following are the agencies with whom the city is partnering with in terms of biodiversity related activities, projects and programmes:

- ICLEI – Local Governments for Sustainability, South Asia: Developing the CBI and the LBSAP for Jammu city.
- Mata Vaishnadevi Shrine University: Working on preparation of Detailed Project Reports and plans for landscaping and beautification in the Jammu city region.
- Indian Institute of Technology, Jammu: Consultant for Smart City Projects within the Jammu city region, working on rejuvenation of water canals and riverfront development.
- Roddick Consultants: Development of the Smart City Plan/infrastructure with avenue and traffic beautification by plantations, vertical gardens etc.
- Jal Shakti and Department of Irrigation, Jammu: Working on the blue green projects related to Ranbir and Tawi canals of the Jammu city.
- Apart from the above-mentioned organisations, the Jammu city also works with 13 local NGOs. They are Talent Club, Jagriti Mahila Udhyog Kender, Swarangan Meditation Charitable Trust, National Council for Urban and Rural Development Society, Sain Baba Society, National Development Organisation, Urban & Rural Sanitation Club, National Youth Child and Women Empowerment Society, Jammu and Kashmir City Sanitation Society, Society for Scheduled and Backwards, J&K Public Welfare and Dev. Society, Association for Socio-Economic & Environment Development, Multiple Action Research Group (MARG). All of these NGOs work in Jammu city, supporting different sanitation activities which indirectly impact biodiversity.

RESULT: 21

SCORE: 4

Recommendations to Maintain Score

The city of Jammu has scored well in this indicator, however a majority of partnerships are based on sanitation projects. JMC should look into forging partnerships with NGOs working on other environmental based activities especially with a focus on biodiversity. Several academic institutions like SKUAST Jammu and Jammu University can support the city with developing and maintaining biodiversity inventories. The BMC can initiate partnerships with these institutions. The BMC can also take up the responsibility of identifying areas in the city which were sites managed by the Baradari system. Partnerships with these guardians can support the city's natural and cultural heritage, while also providing citizens and tourists with areas for recreation. Furthermore, partnerships can also be developed with farmer associations and other agricultural land holders to develop green spaces though a mutually beneficial financial model.

Indicator 22 : Education and Awareness: Is Biodiversity or Nature Awareness included in the School Curriculum

Methodology

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

Scoring Range: (based on the CBI user manual)

0 point:	Biodiversity or elements of it are not covered in the school curriculum
1 point:	Biodiversity or elements of it are being considered for inclusion in the school curriculum
2 points:	Biodiversity or elements of it are being planned for inclusion in the school curriculum
3 points:	Biodiversity or elements of it are in the process of being implemented in the school curriculum
4 points:	Biodiversity or elements of it are included in the school curriculum

City Data and Calculations

The schools within the city limits follow the curriculum of various boards such as the Jammu and Kashmir Board of School Education, Central Board of Secondary Education (CBSE) and Indian Certificate of Secondary Education (ICSE). All of these boards have included biodiversity and nature awareness in various subjects like Biology, Geography, and Environmental Sciences. Therefore, biodiversity or elements of it are included in the school curriculum.

RESULT: Yes

SCORE: 4

Recommendations to Maintain Score

Though the city has scored very high here, it needs to be noted that this indicator measures the theoretical aspects of biodiversity education only. Indicator 14 which measures practical aspects of biodiversity education, saw the city receiving the lowest score possible. This highlights that environmental education not just in Jammu, but in the country at large needs to strike the right balance between theory and practice. In order to address the same, the city administration can give a directive to all schools to include visits to parks and biodiversity facilities in their curriculum. The city administration should send a request in this regard to all the school boards, through the UT government.

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

Methodology

How to calculate indicator
Number of outreach or public awareness events held in the city per year.

Scoring Range: (based on the CBI user manual)
0 point: 0 outreach events/year
1 point: 1 - 59 outreach events/year
2 points: 60 -149 outreach events/year
3 points: 150-300 outreach events/year
4 points: > 300 outreach events/year

City Data and Calculations
JMC conducts more than 100 awareness programmes under the Swachh Bharat Mission in the city, on a yearly basis. The National Cadet Corps wing of Indian Armed Forces does street plays under the Swachh Bharat campaigns. Apart from these campaigns, the city is also involved in in awareness programmes like anti-plastic radio and media campaigns such as 'Plastic Lao, Thaila Le Jao'. Jammu Municipal Corporation has also organised awareness programs on Azadi Ka Amrit Mahotsav' on the 75th Independence Day of India. The programme included a Marathon run from the Maulana Azad Stadium in Jammu with a message to the city residents to avoid plastic usage and to use more jute or paper bags. The celebration of Van Mahotsav, World Environment Day, International Day of Forests, World Earth Day, International Day for Biological Diversity, World Wildlife Day etc. are carried out regularly by the city which includes awareness programmes around reafforestation.

RESULT: 60-149

SCORE: 2

Recommendations to Improve Score

The city of Jammu has scored poorly for this indicator. The BMC can play an active role in improving this score by forging partnerships with local NGOs, clubs and societies to conduct more awareness programmes. Online events can also be promoted by JMC.

Table 7: Summary of the Points

	Maximum Score	Jammu's Score
Component – Native Biodiversity		
Indicators		
1. Proportion of Natural Areas in the City	4 points	2 points
2. Connectivity Measures	4 points	1 point
3. Native Biodiversity in Built Up Areas (Bird Species)	4 points	4 points
4. Change in Number of Vascular Plant Species	4 points	N/A
5. Change in Number of Bird Species	4 points	N/A
6. Change in Number of Freshwater fish Species	4 points	N/A
7. Change in Number of Species (Odonates)	4 points	N/A
8. Change in Number of Species (Amphibians)	4 points	N/A
9. Proportion of Protected Natural Areas	4 points	3 points
10. Proportion of Invasive Alien Species	4 points	1 point
Component – Ecosystem Services Provided by Biodiversity		
Indicators		
11. Regulation of Quantity of Water	4 points	3 points
12. Climate Regulation: Carbon Storage and Cooling Effect of Vegetation	4 points	1 point
13. Recreation and Education: Area of Parks with Natural Areas	4 points	4 points
14. Recreation and Education:Number of Formal Education Visits per Child Below 16 Years to Parks with Natural Areas per Year	4 points	0 point
Component – Governance and Management of Biodiversity		
Indicators		
15. Budget Allocated to Biodiversity	4 points	4 points
16. Number of Biodiversity Projects Implemented by the City Annually	4 points	1 point
17. Existence of Local Biodiversity Strategy and Action Plan	4 points	0 point
18. Institutional Capacity: Number of Biodiversity Related Function	4 points	4 points
19. Institutional Capacity: Number of City or Local Government Agencies Involved in Inter-agency Cooperation Pertaining to Biodiversity Matters	4 points	2 points
20. Participation and Partnership: Existence of Formal or Informal Public Consultation Process	4 points	0 point
21. Participation and Partnership: Number of Agencies/Private Companies/ NGOs/Academic Institutions/International Organisations with which the City is Partnering in Biodiversity Activities, Projects and Programmes	4 points	4 points
22. Education and Awareness: Is Biodiversity or Nature Awareness Included in the School Curriculum	4 points	4 points
23. Education and Awareness: Number of Outreach or Public Awareness Events Held in the City per Year	4 points	2 points
Component – Native Biodiversity in the City (Sub-total for indicators 1-10)*		**11 / 20 points***
Component – Ecosystem Services provided by Biodiversity (Sub-total for indicators 11-14)		**8 / 16 points**
Component – Governance and Management of Biodiversity (Sub-total for indicators 15-23)		**21 / 36 points**
Total		**40 / 72 points**

*A total of 20 points only for this section is considered, since this is the baseline assessment and hence the indicators 4-8 cannot be considered.

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ANNEXURE 1 – CALCULATION OF CONNECTIVITY AREAS

Table 8: Natural area patches used in the calculation of Indicator 2

Patch ID	Area in ha (patch size)	Area * Area (Sq. h)	Patch ID	Area in ha (patch size)	Area * Area (Sq. h)
A1	737.30	543609.82	A41	1.72	2.97
A2	489.88	239981.43	A42	1.66	2.75
A3	86.67	7510.93	A43	1.63	2.66
A4	75.46	5694.27	A44	1.60	2.58
A5	67.09	4501.30	A45	1.58	2.51
A6	45.83	2100.56	A46	1.54	2.36
A7	31.06	964.58	A47	1.51	2.28
A8	21.76	473.61	A48	1.47	2.17
A9	12.37	152.98	A49	1.46	2.14
A10	11.48	131.86	A50	1.45	2.10
A11	11.00	120.92	A51	1.41	2.00
A12	9.45	89.36	A52	1.39	1.93
A13	7.27	52.89	A53	1.39	1.92
A14	7.16	51.20	A54	1.20	1.45
A15	7.13	50.87	A55	1.20	1.44
A16	5.03	25.34	A56	1.13	1.28
A17	4.96	24.56	A57	0.99	0.99
A18	4.87	23.69	A58	0.99	0.98
A19	4.86	23.63	A59	0.95	0.90
A20	4.55	20.67	A60	0.90	0.81
A21	4.20	17.64	A61	0.86	0.73
A22	4.05	16.39	A62	0.80	0.64
A23	3.91	15.27	A63	0.75	0.56
A24	3.57	12.76	A64	0.71	0.50
A25	3.44	11.81	A65	0.70	0.48
A26	3.43	11.76	A66	0.69	0.48
A27	3.37	11.32	A67	0.63	0.40
A28	3.27	10.67	A68	0.61	0.37
A29	3.11	9.66	A69	0.60	0.36
A30	3.02	9.11	A70	0.56	0.31
A31	2.69	7.22	A71	0.55	0.30
A32	2.66	7.07	A72	0.55	0.30
A33	2.44	5.96	A73	0.55	0.30
A34	2.24	5.02	A74	0.52	0.27
A35	2.12	4.50	A75	0.51	0.26
A36	2.00	3.98	A76	0.47	0.22
A37	1.99	3.97	A77	0.47	0.22
A38	1.99	3.97	A78	0.45	0.21
A39	1.86	3.45	A79	0.45	0.21
A40	1.77	3.14	A80	0.45	0.20

Patch ID	Area in ha (patch size)	Area * Area (Sq. h)
A81	0.42	0.18
A82	0.41	0.17
A83	0.40	0.16
A84	0.36	0.13
A85	0.36	0.13
A86	0.35	0.12
A87	0.34	0.12
A88	0.33	0.11
A89	0.32	0.10
A90	0.32	0.10
A91	0.31	0.09
A92	0.30	0.09
A93	0.30	0.09
A94	0.28	0.08
A95	0.27	0.07
A96	0.26	0.07
A97	0.26	0.07
A98	0.23	0.05
A99	0.22	0.05
A100	0.22	0.05
A101	0.21	0.04
A102	0.19	0.04
A103	0.19	0.03
A104	0.18	0.03
A105	0.18	0.03
A106	0.18	0.03
A107	0.18	0.03
A108	0.18	0.03
A109	0.17	0.03
A110	0.17	0.03

Patch ID	Area in ha (patch size)	Area * Area (Sq. h)
A111	0.17	0.03
A112	0.16	0.03
A113	0.16	0.02
A114	0.15	0.02
A115	0.12	0.02
A116	0.10	0.01
A117	0.10	0.01
A118	0.10	0.01
A119	0.09	0.01
A120	0.08	0.01
A121	0.08	0.01
A122	0.08	0.01
A123	0.08	0.01
A124	0.07	0.00
A125	0.06	0.00
A126	0.06	0.00
A127	0.05	0.00
A128	0.05	0.00
A129	0.05	0.00
A130	0.05	0.00
A131	0.04	0.00
A132	0.03	0.00
A133	0.03	0.00
A134	0.02	0.00
A135	0.02	0.00
A136	0.02	0.00
A137	0.02	0.00
A138	0.01	0.00
Total	**1751.50**	**805827.25**

ANNEXURE 2 – CHECKLIST OF SPECIES IN JAMMU CITY

Table 9: Bird Species used in the calculation of Indicator 3 and 5

Sl. No.	Family	Common Name	Scientific Name	Migrant	Urban
Waterfowl					
1	Anatidae	Lesser Whistling-Duck	*Dendrocygna javanica*	Resident	Yes
2	Anatidae	Bar-headed Goose	*Anser indicus*	Winter	No
3	Anatidae	Ruddy Shelduck (Brahminy Duck)	*Tadorna ferruginea*	Winter	Yes
4	Anatidae	Garganey	*Spatula querquedula*	Winter	Yes
5	Anatidae	Northern Shoveler	*Spatula clypeata*	Winter	Yes
6	Anatidae	Gadwall	*Mareca strepera*	Winter	Yes
7	Anatidae	Indian Spot-billed Duck	*Anas poecilorhyncha*	Resident	Yes
8	Anatidae	Mallard	*Anas platyrhynchos*	Winter	Yes
9	Anatidae	Northern Pintail	*Anas acuta*	Winter	Yes
10	Anatidae	Green-winged Teal (Common Teal)	*Anas crecca*	Winter	Yes
11	Anatidae	Common Pochard	*Aythya ferina*	Winter	No
Grouse, Quail, and Allies					
12	Phasianidae	Black Francolin	*Francolinus francolinus*	Summer	No
13	Phasianidae	Grey Francolin	*Francolinus pondicerianus*	Resident	Yes
Grebes					
14	Podicipedidae	Little Grebe	*Tachybaptus ruficollis*	Winter	Yes
Pigeons and Doves					
15	Columbidae	Rock Pigeon (Blue Rock Pigeon)	*Columba livia*	Resident	Yes
16	Columbidae	Eurasian Collared-Dove	*Streptopelia decaocto*	Resident	Yes
17	Columbidae	Spotted Dove	*Streptopelia chinensis*	Resident	Yes
18	Columbidae	Laughing Dove (Little Brown Dove)	*Streptopelia senegalensis*	Resident	Yes
19	Columbidae	Yellow-footed Green-Pigeon	*Treron phoenicopterus*	Summer	Yes
20	Columbidae	Oriental Turtle-Dove	*Streptopelia orientalis*	Summer	No
21	Columbidae	Red Collared-Dove (Red Turtle-Dove)	*Streptopelia tranquebarica*	Summer	No
22	Columbidae	Asian Emerald Dove	*Chalcophaps indica*	Vagrant	Yes
Cuckoos					
	Cuculidae	Greater Coucal	*Centropus sinensis*	Resident	Yes
25	Cuculidae	Asian Koel	*Eudynamys scolopaceus*	Summer	Yes
26	Cuculidae	Common Hawk-Cuckoo	*Hierococcyx varius*	Summer	Yes
27	Cuculidae	Pied Cuckoo (Jacobin Cuckoo)	*Clamator jacobinus*	Summer	Yes

Sl. No.	Family	Common Name	Scientific Name	Migrant	Urban
28	Cuculidae	Common Cuckoo	*Cuculus canorus*	Summer	Yes
29	Cuculidae	Grey-bellied Cuckoo	*Cacomantis passerinus*	Summer	Yes
Rails, Gallinules, and Allies					
30	Rallidae	Eurasian Moorhen	*Gallinula chloropus*	Resident	Yes
31	Rallidae	Eurasian Coot	*Fulica atra*	Winter	Yes
32	Rallidae	Grey-headed Swamphen (Purple Swamphen)	*Porphyrio poliocephalus*	Resident	Yes
33	Rallidae	White-breasted Waterhen	*Amaurornis phoenicurus*	Resident	Yes
Cranes					
34	Gruidae	Common Crane	*Grus grus*	Winter	No
Shorebirds					
35	Burhinidae	Indian Thick-knee (Indian Stone-curlew)	*Burhinus indicus*	Resident	Yes
36	Burhinidae	Black-winged Stilt	*Himantopus himantopus*	Winter	Yes
37	Charadriidae	River Lapwing	*Vanellus duvaucelii*	Resident	No
38	Charadriidae	Northern Lapwing	*Vanellus vanellus*	Winter	Yes
39	Charadriidae	Red-wattled Lapwing	*Vanellus indicus*	Resident	Yes
40	Charadriidae	White-tailed Lapwing	*Vanellus leucurus*	Winter	Yes
41	Charadriidae	Yellow-wattled Lapwing	*Vanellus malabaricus*	Winter	No
42	Charadriidae	Kentish Plover	*Charadrius alexandrinus*	Winter	No
43	Charadriidae	Little Ringed Plover	*Charadrius dubius*	Resident	Yes
44	Scolopacidae	Ruff	*Calidris pugnax*	Winter	Yes
45	Scolopacidae	Temminck's Stint	*Calidris temminckii*	Winter	Yes
46	Scolopacidae	Little Stint	*Calidris minuta*	Passage	No
47	Scolopacidae	Common Snipe	*Gallinago gallinago*	Winter	Yes
48	Scolopacidae	Common Sandpiper	*Actitis hypoleucos*	Resident	Yes
49	Scolopacidae	Green Sandpiper	*Tringa ochropus*	Resident	Yes
50	Scolopacidae	Common Greenshank	*Tringa nebularia*	Winter	Yes
51	Scolopacidae	Marsh Sandpiper	*Tringa stagnatilis*	Passage	Yes
52	Scolopacidae	Wood Sandpiper	*Tringa glareola*	Winter	Yes
53	Scolopacidae	Common Redshank	*Tringa totanus*	Winter	Yes
54	Glareolidae	Oriental Pratincole	*Glareola maldivarum*	Passage	No
55	Glareolidae	Small Pratincole	*Glareola lactea*	Winter	Yes
Gulls, Terns, and Skimmers					
56	Laridae	Whiskered Tern	*Chlidonias hybrida*	Summer	Yes
57	Laridae	River Tern	*Sterna aurantia*	Winter	Yes
Storks					
58	Ciconiidae	Woolly-necked Stork	*Ciconia episcopus*	Winter	No
59	Ciconiidae	Black Stork	*Ciconia nigra*	Winter	Yes
Cormorants and Anhingas					
60	Phalacrocoracidae	Little Cormorant	*Microcarbo niger*	Resident	Yes
61	Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	Resident	Yes
62	Phalacrocoracidae	Indian Cormorant (Indian Shag)	*Phalacrocorax fuscicollis*	Winter	No

Sl. No.	Family	Common Name	Scientific Name	Migrant	Urban
Herons, Ibis, and Allies					
63	Ardeidae	Grey Heron	*Ardea cinerea*	Winter	Yes
64	Ardeidae	Purple Heron	*Ardea purpurea*	Winter	Yes
65	Ardeidae	Great Egret	*Ardea alba*	Winter	Yes
66	Ardeidae	Intermediate Egret	*Ardea intermedia*	Winter	Yes
67	Ardeidae	Little Egret	*Egretta garzetta*	Resident	Yes
68	Ardeidae	Cattle Egret	*Bubulcus ibis*	Resident	Yes
69	Ardeidae	Indian Pond-Heron	*Ardeola grayii*	Resident	Yes
70	Ardeidae	Black-crowned Night-Heron	*Nycticorax nycticorax*	Resident	No
71	Ardeidae	Black Bittern	*Ixobrychus flavicollis*	Winter	Yes
Long Leg Waders					
72	Threskiornithidae	Red-naped Ibis (Indian Black Ibis)	*Pseudibis papillosa*	Winter	No
Vultures, Hawks, and Allies					
73	Pandionidae	Osprey	*Pandion haliaetus*	Winter	No
74	Accipitridae	Black-winged Kite (Black-shouldered Kite)	*Elanus caeruleus*	Resident	Yes
75	Accipitridae	Egyptian Vulture	*Neophron percnopterus*	Resident	Yes
76	Accipitridae	Oriental Honey-buzzard (Crested Honey Buzzard)	*Pernis ptilorhynchus*	Summer	Yes
77	Accipitridae	Himalayan Griffon (Himalayan Vulture)	*Gyps himalayensis*	Resident	Yes
78	Accipitridae	Eurasian Griffon (Griffon Vulture)	*Gyps fulvus*	Resident	Yes
79	Accipitridae	Steppe Eagle	*Aquila nipalensis*	Winter	Yes
80	Accipitridae	White-eyed Buzzard	*Butastur teesa*	Summer	Yes
81	Accipitridae	Eurasian Marsh-Harrier	*Circus aeruginosus*	Winter	Yes
82	Accipitridae	Hen Harrier	*Circus cyaneus*	Winter	Yes
83	Accipitridae	Shikra	*Accipiter badius*	Resident	Yes
84	Accipitridae	Black Kite	*Milvus migrans*	Resident	Yes
85	Accipitridae	Long-legged Buzzard	*Buteo rufinus*	Winter	Yes
86	Accipitridae	Cinereous Vulture	*Aegypius monachus*	Winter	No
87	Accipitridae	Indian Spotted Eagle	*Clanga hastata*	Winter	No
88	Accipitridae	Booted Eagle	*Hieraaetus pennatus*	Resident	Yes
89	Accipitridae	Eurasian Sparrowhawk	*Accipiter nisus*	Resident	Yes
90	Accipitridae	Besra	*Accipiter virgatus*	Vagrant	No
Owls					
91	Strigidae	Spotted Owlet	*Athene brama*	Resident	Yes
92	Strigidae	Short-eared Owl	*Asio flammeus*	Winter	Yes
93	Strigidae	Indian Scops-Owl	*Otus bakkamoena*	Resident	Yes
94	Strigidae	Asian Barred Owlet	*Glaucidium cuculoides*	Resident	Yes
95	Tytonidae	Barn Owl	*Tyto alba*	Resident	Yes
96	Strigidae	Collared Scops-Owl	*Otus lettia*	Passage	Yes
Hoopoes					
97	Upupidae	Eurasian Hoopoe	*Upupa epops*	Resident	Yes

Sl. No.	Family	Common Name	Scientific Name	Migrant	Urban
Hornbills					
98	Bucerotidae	Indian Grey Hornbill	*Ocyceros birostris*	Resident	Yes
Kingfishers					
99	Alcedinidae	Common Kingfisher (Small Blue Kingfisher)	*Alcedo atthis*	Resident	Yes
100	Alcedinidae	White-throated Kingfisher	*Halcyon smyrnensis*	Resident	Yes
101	Alcedinidae	Pied Kingfisher	*Ceryle rudis*	Resident	Yes
Bee-eaters, Rollers, and Allies					
102	Meropidae	Green Bee-eater	*Merops orientalis*	Summer	Yes
103	Meropidae	Blue-tailed Bee-eater	*Merops philippinus*	Summer	Yes
104	Coraciidae	Indian Roller	*Coracias benghalensis*	Summer	Yes
Barbets and Toucans					
105	Megalaimidae	Coppersmith Barbet	*Psilopogon haemacephalus*	Resident	Yes
106	Megalaimidae	Brown-headed Barbet (Large Green Barbet)	*Psilopogon zeylanicus*	Resident	Yes
107	Megalaimidae	Great Barbet	*Psilopogon virens*	Resident	Yes
108	Megalaimidae	Blue-throated Barbet	*Psilopogon asiaticus*	Resident	No
Woodpeckers					
109	Picidae	Eurasian Wryneck	*Jynx torquilla*	Resident	Yes
110	Picidae	Black-rumped Flameback (Lesser Goldenbacked Woodpecker)	*Dinopium benghalense*	Resident	Yes
111	Picidae	Fulvous-breasted Woodpecker	*Dendrocopos macei*	Resident	Yes
112	Picidae	Scaly-bellied Woodpecker	*Picus squamatus*	Summer	No
113	Picidae	Brown-capped Woodpecker	*Picoides nanus*	Resident	No
114	Picidae	Himalayan Woodpecker	*Dendrocopos himalayensis*	Vagrant	No
115	Picidae	Rufous-bellied Woodpecker	*Dendrocopos hyperythrus*	Vagrant	Yes
Falcons and Caracaras					
116	Falconidae	Eurasian Kestrel (Common Kestrel)	*Falco tinnunculus*	Resident	Yes
117	Falconidae	Peregrine Falcon	*Falco peregrinus*	Resident	Yes
Parrots, Parakeets, and Allies					
118	Psittaculidae	Alexandrine Parakeet	*Psittacula eupatria*	Resident	Yes
119	Psittaculidae	Rose-ringed Parakeet	*Psittacula krameri*	Resident	Yes
120	Psittaculidae	Plum-headed Parakeet	*Psittacula cyanocephala*	Resident	Yes
121	Psittaculidae	Red-breasted Parakeet	*Psittacula alexandri*	Vagrant	Yes
Cuckooshrikes					
122	Campephagidae	Long-tailed Minivet	*Pericrocotus ethologus*	Passage	Yes
123	Campephagidae	Small Minivet	*Pericrocotus cinnamomeus*	Resident	Yes
Fantails					
124	Rhipiduridae	White-throated Fantail	*Rhipidura albicollis*	Resident	Yes
Drongos					
125	Dicruridae	Black Drongo	*Dicrurus macrocercus*	Resident	Yes

Sl. No.	Family	Common Name	Scientific Name	Migrant	Urban
126	Dicruridae	Ashy Drongo	*Dicrurus leucophaeus*	Summer	Yes
127	Dicruridae	Hair-crested Drongo (Spangled Drongo)	*Dicrurus hottentottus*	Resident	Yes
Shrikes					
128	Laniidae	Isabelline Shrike	*Lanius isabellinus*	Winter	No
129	Laniidae	Bay-backed Shrike	*Lanius vittatus*	Winter	No
130	Laniidae	Long-tailed Shrike	*Lanius schach*	Resident	Yes
131	Laniidae	Grey-backed Shrike	*Lanius tephronotus*	Summer	No
132	Laniidae	Brown Shrike	*Lanius cristatus*	Vagrant	No
Jays, Magpies, Crows, and Ravens					
133	Corvidae	Rufous Treepie	*Dendrocitta vagabunda*	Resident	Yes
134	Corvidae	House Crow	*Corvus splendens*	Resident	Yes
135	Corvidae	Large-billed Crow	*Corvus macrorhynchos*	Resident	Yes
136	Corvidae	Common Raven (Northern Raven)	*Corvus corax*	Resident	Yes
Fairy Flycatchers					
137	Stenostiridae	Yellow-bellied Fantail	*Chelidorhynx hypoxanthus*	Winter	Yes
138	Stenostiridae	Grey-headed Canary-Flycatcher	*Culicicapa ceylonensis*	Winter	Yes
Tits, Chickadees, and Titmice					
139	Paridae	Cinereous Tit (Great Tit)	*Parus cinereus*	Resident	Yes
Larks					
140	Alaudidae	Ashy-crowned Sparrow-Lark (Ashy-crowned Finch-Lark)	*Eremopterix griseus*	Resident	Yes
141	Alaudidae	Bengal Bushlark	*Mirafra assamica*	Resident	Yes
142	Alaudidae	Eurasian Skylark	*Alauda arvensis*	Winter	Yes
143	Alaudidae	Oriental Skylark	*Alauda gulgula*	Winter	Yes
144	Alaudidae	Crested Lark	*Galerida cristata*	Resident	Yes
Cisticolas and Allies					
145	Cisticolidae	Common Tailorbird	*Orthotomus sutorius*	Resident	Yes
146	Cisticolidae	Grey-breasted Prinia	*Prinia hodgsonii*	Resident	Yes
147	Cisticolidae	Ashy Prinia	*Prinia socialis*	Resident	Yes
148	Cisticolidae	Plain Prinia	*Prinia inornata*	Resident	Yes
149	Cisticolidae	Zitting Cisticola	*Cisticola juncidis*	Resident	No
150	Cisticolidae	Striated Prinia	*Prinia crinigera*	Winter	No
151	Cisticolidae	Rufous-fronted Prinia	*Prinia buchanani*	Passage	No
Martins and Swallows					
152	Hirundinidae	Grey-throated Martin (Plain Martin)	*Riparia chinensis*	Resident	Yes
153	Hirundinidae	Barn Swallow	*Hirundo rustica*	Resident	Yes
154	Hirundinidae	Wire-tailed Swallow	*Hirundo smithii*	Winter	Yes
155	Hirundinidae	Streak-throated Swallow	*Petrochelidon fluvicola*	Winter	Yes
156	Hirundinidae	Red-rumped Swallow	*Cecropis daurica*	Summer	Yes
Bulbuls					
157	Pycnonotidae	Red-vented Bulbul	*Pycnonotus cafer*	Resident	Yes

Sl. No.	Family	Common Name	Scientific Name	Migrant	Urban
158	Pycnonotidae	Himalayan Bulbul (White-cheeked Bulbul)	*Pycnonotus leucogenys*	Resident	Yes
159	Pycnonotidae	Himalayan Black Bulbul	*Hypsipetes leucocephalus*	Summer	No
Leaf Warblers					
160	Phylloscopidae	Hume's Warbler	*Phylloscopus humei*	Resident	Yes
161	Phylloscopidae	Sulphur-bellied Warbler	*Phylloscopus griseolus*	Summer	Yes
162	Phylloscopidae	Common Chiffchaff	*Phylloscopus collybita*	Resident	Yes
163	Phylloscopidae	Grey-hooded Warbler	*Phylloscopus xanthoschistos*	Resident	Yes
164	Phylloscopidae	Lemon-rumped Warbler (Pale-rumped Warbler)	*Phylloscopus chloronotus*	Winter	Yes
165	Phylloscopidae	Green Warbler	*Phylloscopus nitidus*	Summer	Yes
166	Phylloscopidae	Greenish Warbler	*Phylloscopus trochiloides*	Summer	Yes
167	Phylloscopidae	Western Crowned Warbler	*Phylloscopus occipitalis*	Winter	Yes
Sylviid Warblers					
168	Sylviidae	Asian Desert Warbler	*Sylvia nana*	Winter	Yes
169	Sylviidae	Lesser Whitethroat	*Sylvia curruca*	Resident	Yes
Parrotbills, Wrentit, and Allies					
170	Paradoxornithidae	Yellow-eyed Babbler	*Chrysomma sinense*	Resident	Yes
White-eyes, Yuhinas, and Allies					
171	Zosteropidae	Indian White-eye (Oriental White-eye)	*Zosterops palpebrosus*	Resident	Yes
Tree-Babblers, Scimitar-Babblers, and Allies					
172	Timaliidae	Black-chinned Babbler	*Cyanoderma pyrrhops*	Resident	Yes
Laughingthrushes and Allies					
173	Leiothrichidae	Common Babbler	*Turdoides caudata*	Resident	No
174	Leiothrichidae	Jungle Babbler	*Turdoides striata*	Resident	Yes
Treecreepers					
175	Certhiidae	Bar-tailed Treecreeper	*Certhia himalayana*	Winter	Yes
		Starlings and Mynas			
176	Sturnidae	European Starling (Common Starling)	*Sturnus vulgaris*	Resident	Yes
177	Sturnidae	Asian Pied Starling (Pied Myna)	*Gracupica contra*	Resident	Yes
178	Sturnidae	Brahminy Starling	*Sturnia pagodarum*	Resident	Yes
179	Sturnidae	Common Myna	*Acridotheres tristis*	Resident	Yes
180	Sturnidae	Bank Myna	*Acridotheres ginginianus*	Resident	Yes
181	Sturnidae	Chestnut-tailed Starling	*Sturnia malabarica*	Winter	Yes
182	Sturnidae	Jungle Myna	*Acridotheres fuscus*	Resident	Yes
183	Sturnidae	Rosy Starling	*Pastor roseus*	Summer	No
Thrushes					
184	Turdidae	Black-throated Thrush	*Turdus atrogularis*	Passage	Yes
185	Turdidae	Grey-winged Blackbird	*Turdus boulboul*	Winter	Yes
186	Turdidae	Tickell's Thrush	*Turdus unicolor*	Vagrant	Yes
Old World Flycatchers					
187	Muscicapidae	Indian Robin	*Copsychus fulicatus*	Resident	Yes

Sl. No.	Family	Common Name	Scientific Name	Migrant	Urban
188	Muscicapidae	Oriental Magpie-Robin	*Copsychus saularis*	Resident	Yes
189	Muscicapidae	Bluethroat	*Luscinia svecica*	Winter	Yes
190	Muscicapidae	Blue Whistling-Thrush	*Myophonus caeruleus*	Resident	Yes
191	Muscicapidae	Plumbeous Redstart	*Phoenicurus fuliginosus*	Winter	No
192	Muscicapidae	Black Redstart	*Phoenicurus ochruros*	Resident	Yes
193	Muscicapidae	Chestnut-bellied Rock-Thrush	*Monticola rufiventris*	Resident	No
194	Muscicapidae	Siberian Stonechat (Common Stonechat)	*Saxicola maurus*	Resident	Yes
195	Muscicapidae	Pied Bushchat	*Saxicola caprata*	Resident	Yes
196	Muscicapidae	Grey Bushchat	*Saxicola ferreus*	Resident	Yes
197	Muscicapidae	Brown Rock Chat (Indian Chat)	*Oenanthe fusca*	Resident	Yes
198	Muscicapidae	Variable Wheatear	*Oenanthe picata*	Winter	Yes
199	Muscicapidae	Verditer Flycatcher	*Eumyias thalassinus*	Summer	Yes
200	Muscicapidae	Slaty-blue Flycatcher	*Ficedula tricolor*	Resident	Yes
201	Muscicapidae	Red-breasted Flycatcher	*Ficedula parva*	Winter	Yes
202	Muscicapidae	Blue-capped Redstart	*Phoenicurus coeruleocephala*	Winter	No
203	Muscicapidae	Blue-capped Rock-Thrush	*Monticola cinclorhyncha*	Summer	No
204	Muscicapidae	White-capped Redstart	*Phoenicurus leucocephalus*	Winter	No
205	Muscicapidae	Asian Brown Flycatcher	*Muscicapa dauurica*	Vagrant	No
206	Muscicapidae	Blue-fronted Redstart	*Phoenicurus frontalis*	Winter	Yes
207	Muscicapidae	Blue-throated Flycatcher	*Cyornis rubeculoides*	Summer	Yes
208	Muscicapidae	Orange-headed Thrush	*Geokichla citrina*	Winter	Yes
209	Muscicapidae	Desert Wheatear	*Oenanthe deserti*	Winter	No
Sunbirds and Spiderhunters					
210	Nectariniidae	Purple Sunbird	*Cinnyris asiaticus*	Summer	Yes
211	Nectariniidae	Crimson Sunbird	*Aethopyga siparaja*	Winter	Yes
Estrildids					
212	Estrildidae	Indian Silverbill (White-throated Munia)	*Euodice malabarica*	Resident	Yes
213	Estrildidae	Scaly-breasted Munia (Spotted Munia)	*Lonchura punctulata*	Resident	Yes
214	Estrildidae	Tricolored Munia	*Lonchura malacca*	Vagrant	No
Old World Sparrows					
215	Passeridae	House Sparrow	*Passer domesticus*	Resident	Yes
216	Passeridae	Yellow-throated Sparrow (Chestnut-shouldered Petronia)	*Gymnoris xanthocollis*	Resident	Yes
Wagtails and Pipits					
217	Motacillidae	Grey Wagtail	*Motacilla cinerea*	Winter	Yes
218	Motacillidae	Western Yellow Wagtail	*Motacilla flava*	Winter	Yes
219	Motacillidae	Citrine Wagtail	*Motacilla citreola*	Resident	Yes
220	Motacillidae	White-browed Wagtail (Large Pied Wagtail)	*Motacilla maderaspatensis*	Winter	No

Sl. No.	Family	Common Name	Scientific Name	Migrant	Urban
221	Motacillidae	White Wagtail	*Motacilla alba*	Resident	Yes
222	Motacillidae	Paddyfield Pipit	*Anthus rufulus*	Winter	Yes
223	Motacillidae	Long-billed Pipit	*Anthus similis*	Winter	Yes
224	Motacillidae	Tawny Pipit	*Anthus campestris*	Passage	No
225	Motacillidae	Rosy Pipit	*Anthus roseatus*	Winter	No
226	Motacillidae	Olive-backed Pipit	*Anthus hodgsoni*	Vagrant	No
227	Motacillidae	Water Pipit	*Anthus spinoletta*	Winter	Yes
228	Motacillidae	Tree Pipit	*Anthus trivialis*	Winter	No
Finches, Euphonias, and Allies					
229	Fringillidae	Yellow-breasted Greenfinch	*Chloris spinoides*	Winter	Yes
Nightjars					
230	Caprimulgidae	Savanna Nightjar	*Caprimulgus affinis*	Vagrant	Yes
Old World Pittas					
231	Pittidae	Indian Pitta	*Pitta brachyura*	Summer	Yes
Old World Orioles					
232	Oriolidae	Indian Golden Oriole	*Oriolus kundoo*	Summer	Yes
Monarch Flycatchers					
233	Monarchidae	Indian Paradise-Flycatcher	*Terpsiphone paradisi*	Summer	Yes
Reed Warblers and Allies					
234	Acrocephalidae	Blyth's Reed Warbler	*Acrocephalus dumetorum*	Summer	Yes
235	Acrocephalidae	Paddyfield Warbler	*Acrocephalus agricola*	Winter	No
Flowerpeckers					
236	Dicaeidae	Thick-billed Flowerpecker	*Dicaeum agile*	Summer	Yes
237	Dicaeidae	Pale-billed Flowerpecker	*Dicaeum erythrorhynchos*	Winter	Yes
Bush Warblers and Allies					
238	Cettiidae	Brownish-flanked Bush Warbler	*Horornis fortipes*	Resident	Yes
Buttonquail or Hemipodes					
239	Turnicidae	Barred Buttonquail	*Turnix suscitator*	Vagrant	Yes
		Weavers			
240	Ploceidae	Baya Weaver	*Ploceus philippinus*	Resident	Yes
Accentors					
241	Prunellidae	Black-throated Accentor	*Prunella atrogularis*	Winter	Yes
242	Aegithinidae	Common Iora	*Aegithina tiphia*	Resident	Yes
243	Rostratulidae	Greater Painted-Snipe	*Rostratula benghalensis*	Winter	Yes
244	Emberizidae	Red-headed Bunting	*Emberiza bruniceps*	Passage	No

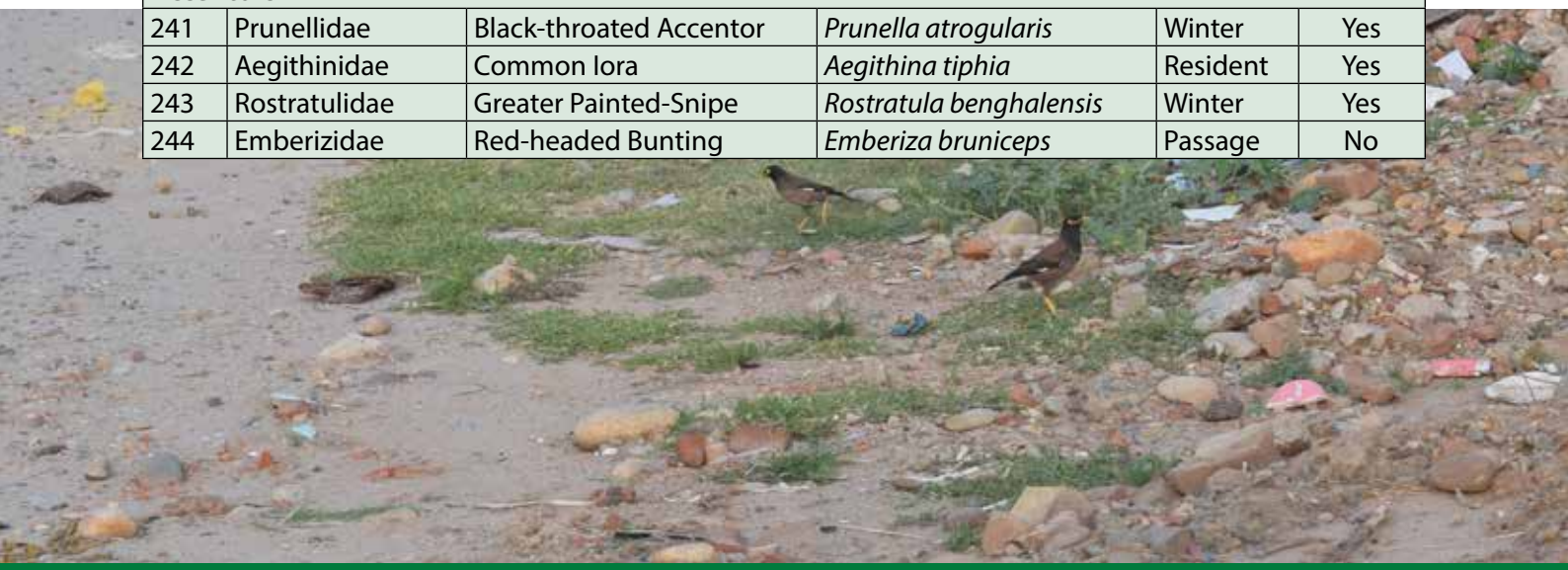


Table 10: Flowering Plant species used in the calculation of Indicators 4 and 10

Sl. No.	Family	Scientific Name	Status
1	Anacardiaceae	*Mangifera indica*	Native
2	Sapindaceae	*Litchi chinensis*	Introduced
3	Myrtaceae	*Psidium guajava*	Introduced
4	Vitaceae	*Vitis vinifera*	Introduced
5	Phyllanthaceae	*Phyllanthus emblica*	Native
6	Rutaceae	*Citrus × aurantium*	Introduced
7	Rutaceae	*Citrus reticulata*	Native
8	Rutaceae	*Citrus aurantifolia*	Native
9	Rutaceae	*Citrus × limon*	Introduced
10	Rutaceae	*Citrus medica*	Introduced
11	Rutaceae	*Citrus jambhiri*	Native
12	Rutaceae	*Citrus limettoides*	Introduced
13	Rutaceae	*Citrus floridana*	Introduced
14	Rutaceae	*Citrus deliciosa*	Introduced
15	Rutaceae	*Limonia acidissima*	Native
16	Rhamnaceae	*Ziziphus mauritiana*	Native
17	Rhamnaceae	*Ziziphus jujuba*	Introduced
18	Malvaceae	*Grewia asiatica*	Native
19	Lythraceae	*Punica granatum*	Introduced
20	Annonaceae	*Annona squamosa*	Introduced
21	Boraginaceae	*Cordia myxa*	Native
22	Apocynaceae	*Carissa carandas*	Native
23	Rosaceae	*Malus domestica*	Introduced
24	Rosaceae	*Pyrus communis*	Introduced
25	Rosaceae	*Prunus persica*	Introduced
26	Rosaceae	*Prunus salicina*	Introduced
27	Rosaceae	*Fragaria ananassa*	Introduced
28	Moraceae	*Morus alba*	Introduced
29	Moraceae	*Ficus carica*	Introduced
30	Moraceae	*Artocarpus lacucha*	Native
31	Moraceae	*Artocarpus heterophyllus*	Native
32	Caricaceae	*Carica papaya*	Introduced
33	Combretaceae	*Terminalia chebula*	Native
34	Combretaceae	*Terminalia bellirica*	Native
35	Myrtaceae	*Eucalyptus grandis*	Introduced
36	Fabaceae	*Albizia lebbeck*	Native
37	Meliaceae	*Toona sureni*	Native
38	Salicaceae	*Populus ciliata*	Native
39	Pinaceae	*Pinus roxburghii*	Native
40	Fabaceae	*Dalbergia sissoo*	Native
41	Fabaceae	*Senegalia catechu*	Native
42	Euphorbiaceae	*Mallotus philippensis*	Native
43	Fabaceae	*Butea monosperma*	Native
44	Sapindaceae	*Dodonaea viscosa*	Introduced
45	Fabaceae	*Vachellia nilotica*	Native

Sl. No.	Family	Scientific Name	Status
46	Lamiaceae	*Tectona grandis*	Native
47	Apocynaceae	*Carissa spinarum*	Native
48	Boraginaceae	*Varronia dichotoma*	Introduced
49	Dioscoreaceae	*Dioscorea bulbifera*	Native
50	Phyllanthaceae	*Phyllanthus emblica*	Native
51	Moraceae	*Ficus palmata*	Native
52	Salicaceae	*Flacourtia indica*	Native
53	Malvaceae	*Malva parviflora*	Introduced
54	Cucurbitaceae	*Momordica dioica*	Native
55	Solanaceae	*Physalis peruviana*	Introduced
56	Alismataceae	*Sagittaria graminea*	Introduced
57	Apocynaceae	*Telosma pallida*	Native
58	Asphodelaceae	*Aloe vera*	Introduced
59	Acanthaceae	*Justicia adhatoda*	Native
60	Acanthaceae	*Barleria cristata*	Native
61	Lamiaceae	*Vitex negundo*	Native
62	Poaceae	*Bambusa bambos*	Native
63	Lamiaceae	*Ocimum tenuiflorum*	Native
64	Poaceae	*Oryza sativa*	Introduced
65	Poaceae	*Zea mays*	Introduced
66	Fabaceae	*Vigna radiata*	Native
67	Fabaceae	*Vigna mungo*	Native
68	Poaceae	*Cenchrus americanus*	Introduced
69	Poaceae	*Triticum aestivum*	Introduced
70	Fabaceae	*Vicia lens*	Native
71	Fabaceae	*Cicer arietinum*	Introduced
72	Fabaceae	*Pisum sativum*	Introduced
73	Liliaceae	*Allium cepa*	Introduced
74	Brassicaceae	*Brassica juncea*	Introduced
75	Brassicaceae	*Brassica napus*	Introduced
76	Linaceae	*Linum usitatissimum*	Introduced
77	Solanaceae	*Solanum tuberosum*	Introduced
78	Pedaliaceae	*Sesamum indicum*	Native
79	Poaceae	*Saccharum officinarum*	Introduced
80	Solanaceae	*Capsicum annuum*	Introduced
81	Solanaceae	*Solanum lycopersicum*	Introduced
82	Malvaceae	*Abelmoschus esculentus*	Native
83	Cucurbitaceae	*Cucumis sativus*	Native
84	Cucurbitaceae	*Lagenaria siceraria*	Introduced
85	Cucurbitaceae	*Momordica charantia*	Native
86	Fabaceae	*Phaseolus vulgaris*	Introduced
87	Brassicaceae	*Brassica oleracea*	Introduced
88	Amaranthaceae	*Beta vulgaris*	Native
89	Brassicaceae	*Raphanus sativus*	Introduced
90	Apiaceae	*Daucus carota*	Native

Sl. No.	Family	Scientific Name	Status
91	Brassicaceae	*Brassica rapa*	Introduced
92	Fabaceae	*Trifolium vavilovii*	Introduced
93	Poaceae	*Avena sativa*	Introduced
94	Poaceae	*Sorghum bicolor*	Introduced
95	Fabaceae	*Vigna unguiculata*	Introduced
96	Amaranthaceae	*Chenopodium album*	IAS
97	Cyperaceae	*Cyperus rotundus*	Native
98	Poaceae	*Echinochloa crus-galli*	IAS
99	Fabaceae	*Medicago denticulata*	Native
100	Poaceae	*Phalaris minor*	Native
101	Fabaceae	*Lathyrus Aphaca*	Native
102	Poaceae	*Cenchrus setigerus*	Native
103	Cannabaceae	*Cannabis sativa*	Introduced
104	Poaceae	*Cynodon dactylon*	Native
105	Poaceae	*Avena sativa*	Introduced
106	Poaceae	*Echinochloa colona*	Native
107	Poaceae	*Sorghum halepense*	Native
108	Amaryllidaceae	*Allium humile*	Native
109	Lythraceae	*Lagerstroemia indica*	Introduced
110	Annonaceae	*Monoon longifolium*	Native
111	Cupressaceae	*Thuja occidentalis*	Introduced
112	Cupressaceae	*Juniperus erecta*	Native
113	Salicaceae	*Salix babylonica*	Introduced
114	Myrtaceae	*Callistemon lanceolatus*	Introduced
115	Euphorbiaceae	*Hevea brasiliensis*	Introduced
116	Cupressaceae	*Cupressus atlantica*	Introduced
117	Fabaceae	*Saraca asoca*	Native
118	Sapotaceae	*Manilkara kauki*	Introduced
119	Moraceae	*Ficus benghalensis*	Native
120	Meliaceae	*Azadirachta indica*	Introduced
121	Sapindaceae	*Koelreuteria paniculata*	Introduced
122	Dilleniaceae	*Dillenia indica*	Native
123	Fabaceae	*Bauhinia × blakeana*	Introduced
124	Casuarinaceae	*Casuarina equisetifolia*	Native
125	Fabaceae	*Delonix regia*	Introduced
126	Platanaceae	*Platanus orientalis*	Introduced
127	Bignoniaceae	*Jacaranda mimosifolia*	Introduced
128	Rubiaceae	*Neolamarckia cadamba*	Native
129	Apocynaceae	*Plumeria Alba*	Introduced
130	Magnoliaceae	*Magnolia grandiflora*	Introduced
131	Arecaceae	*Hyophorbe lagenicaulis*	Introduced
132	Euphorbiaceae	*Macaranga cuspidata*	Introduced
133	Rutaceae	*Aegle marmelos*	Native
134	Proteaceae	*Grevillea robusta*	Introduced
135	Magnoliaceae	*Magnolia champaca*	Native

Sl. No.	Family	Scientific Name	Status
136	Myrtaceae	*Syzygium cumini*	Native
137	Putranjivaceae	*Putranjiva roxburghii*	Native
138	Poaceae	*Gigantochloa atter*	Introduced
139	Oleaceae	*Jasminum officinale*	Native
140	Passifloraceae	*Passiflora princeps*	Introduced
141	Moraceae	*Ficus erecta*	Introduced
142	Araceae	*Epipremnum aureum*	Introduced
143	Apocynaceae	*Nerium oleander*	Native
144	Malvaceae	*Hibiscus rosa sinensis*	Native
145	Bignoniaceae	*Tecoma stans*	Introduced
146	Rubiaceae	*Ixora coccinea*	Native
147	Euphorbiaceae	*Euphorbia pulcherrima*	Introduced
148	Rosaceae	*Rosa canina*	Introduced
149	Rosaceae	*Rosa damascena*	Introduced
150	Rosaceae	*Rosa foetida*	Introduced
151	Rosaceae	*Rosa centifolia*	Introduced
152	Moraceae	*Ficus starlight*	Native
153	Moraceae	*Ficus benjamina*	Native
154	Rubiaceae	*Mussaenda erythrophylla*	Introduced
155	Oleaceae	*Nyctanthes arbor-tristis*	Native
156	Oleaceae	*Jasminum multiflorum*	Native
157	Apocynaceae	*Tabernaemontana divaricata*	Native
158	Nyctaginaceae	*Bougainvillea spectabilis*	Introduced
159	Bignoniaceae	*Tecomaria capensis*	Introduced
160	Solanaceae	*Cestrum nocturnum*	Introduced
161	Rubiaceae	*Gardenia jasmenodes*	Native
162	Euphorbiaceae	*Acalypha poiretii*	Introduced
163	Verbenaceae	*Duranta erecta*	Introduced
164	Rutaceae	*Murraya paniculata*	Native
165	Jasminum humile	*Chrysojasminum humile*	Native
166	Solanaceae	*Datura stramonium*	Introduced
167	Euphorbiaceae	*Jatropha integerrima*	Introduced
168	Crassulaceae	*Kalanchoe blossfeldiana*	Introduced
169	Asparagaceae	*Chlorophytum comosum*	Introduced
170	Lythraceae	*Cuphea hyssopifolia*	Introduced
171	Commelinaceae	*Tradescantia pallida*	Introduced
172	Araceae	*Monstera deliciosa*	Introduced
173	Asparagaceae	*Dracaena trifasciata*	Introduced
174	Asparagaceae	*Dracaena reflexa*	Introduced
175	Araceae	*Syngonium podophyllum*	Introduced
176	Lamiaceae	*Coleus vettiveroides*	Native
177	Iridaceae	*Gladiolus grandiflora*	Introduced
178	Asteraceae	*Dahlia pinnata*	Introduced
179	Verbenaceae	*Verbena officinalis*	Introduced
180	Caryophyllales	*Dianthus arrostii*	Introduced

Sl. No.	Family	Scientific Name	Status
181	Caryophyllaceae	*Dianthus sachalinensis*	Introduced
182	Caryophyllaceae	*Dianthus barbatus*	Introduced
183	Polemoniaceae	*Phlox pilosa*	Introduced
184	Violaceae	*Viola tricolor*	Introduced
185	Asteraceae	*Tagetes erecta*	Introduced
186	Balsaminaceae	*Impatiens balsamina*	Invasive
187	Brassicaceae	*Clypeola jonthlaspi*	Introduced
188	Asteraceae	*Zinnia elegans*	Introduced
189	Asteraceae	*Helianthus annuus*	Introduced
190	Asteraceae	*Dahlia pinnata*	Introduced
191	Malvaceae	*Alcea rosea*	Introduced
192	Solanaceae	*Petunia × atkinsiana*	Introduced
193	Asteraceae	*Gazania rigens*	Introduced
194	Asteraceae	*Gaillardia aristata*	Introduced
195	Amaranthaceae	*Celosia argentea*	Introduced
196	Lamiaceae	*Salvia splendens*	Introduced
197	Veronicaceae	*Antirrhinum charidemi*	Introduced
198	Asteraceae	*Chrysanthemum morifolium*	Introduced
199	Portulacaceae	*Portulaca grandiflora*	Introduced
200	Apocynaceae	*Catharanthus roseus*	Introduced
201	Apocynaceae	*Alstonia scholaris*	Native
202	Malvaceae	*Bombax ceiba*	Native
203	Fabaceae	*Pongamia pinnata*	Native
204	Bignoniaceae	*Kigelia africana*	Introduced
205	Fabaceae	*Senna siamea*	Introduced
206	Fabaceae	*Erythrina variegata*	Native
207	Lythraceae	*Lagerstroemia speciosa*	Native
208	Dipterocarpaceae	*Shorea robusta*	Native
209	Moraceae	*Ficus elastica*	Native
210	Arecaceae	*Washingtonia filifera*	Introduced
211	Apocynaceae	*Tabernaemontana divaricata*	Native
212	Arecaceae	*Dypsis lutescens*	Introduced
213	Araucariaceae	*Araucaria heterophylla*	Introduced
214	Arecaceae	*Bismarckia nobilis*	Introduced
215	Lamiaceae	*Clerodendrum splendens*	Introduced
216	Euphorbiaceae	*Croton scabiosus*	Native
217	Oleaceae	*Jasminum sambac*	Native
218	Euphorbiaceae	*Euphorbia milii*	Introduced
219	Bignoniaceae	*Mansoa alliacea*	Introduced
220	Bignoniaceae	*Pyrostegia venusta*	Introduced
221	Combretaceae	*Combretum indicum*	Native
222	Polygonaceae	*Antigonon leptopus*	Invasive
223	Asparagaceae	*Dracaena mahatma*	Native
224	Asparagaceae	*Agave amica*	Introduced
225	Fabaceae	*Cassia fistula*	Native

Sl. No.	Family	Scientific Name	Status
226	Fabaceae	*Erythrina variegata*	Native
227	Salicaceae	*Salix alba*	Introduced
228	Rosaceae	*Rosa acicularis*	Introduced
229	Fabaceae	*Vachellia nilotica*	Introduced
230	Araceae	*Lemna minor*	Native
231	Convolvulaceae	*Ipomoea acanthocarpa*	Introduced
232	Malvaceae	*Ceiba speciosa*	Introduced
233	Oleaceae	*Nyctanthes arbor-tristis*	Native
234	Rubiaceae	*Hamelia patens*	Introduced
235	Aizoaceae	*Mesembryanthemum nodiflorum*	Introduced
236	Apocynaceae	*Alstonia scholaris*	Native
237	Malvaceae	*Pterospermum acerifolium*	Native
238	Araucariaceae	*Araucaria columnaris*	Introduced
239	Combretaceae	*Terminalia elliptica*	Native
240	Liliaceae	*Lilum asiatica*	Native
241	Myrtaceae	*Syzygium cumini*	Native
242	Fabaceae	*Vachellia farnesiana*	Invasive
243	Amaranthaceae	*Achyranthes aspera*	Invasive
244	Asteraceae	*Ageratum conyzoides*	Invasive
245	Amaranthaceae	*Alternanthera philoxeroides*	Invasive
246	Amaranthaceae	*Alternanthera pungens*	Invasive
247	Amaranthaceae	*Amaranthus viridis*	Invasive
248	Primulaceae	*Anagallis arvensis*	Invasive
249	Papaveraceae	*Argemone mexicana*	Invasive
250	Asteraceae	*Bidens pilosa*	Invasive
251	Apocynaceae	*Calotropis procera*	Invasive
252	Cannaceae	*Canna indica*	Invasive
253	Cannabaceae	*Cannabis sativa*	Invasive
254	Fabaceae	*Cassia occidentalis*	Invasive
255	Cleomaceae	*Cleome viscosa*	Invasive
256	Convolvulaceae	*Cuscuta reflexa*	Invasive
257	Cyperaceae	*Cyperus difformis*	Invasive
258	Cyperaceae	*Cyperus iria*	Invasive
259	Solanaceae	*Datura innoxia*	Invasive
260	Poaceae	*Echinochloa colona*	Invasive
261	Asteraceae	*Eclipta prostrata*	Invasive
262	Pontederiaceae	*Eichhornia crassipes*	Invasive
263	Asteraceae	*Emilia sonchifolia*	Invasive
264	Euphorbiaceae	*Euphorbia heterophylla*	Invasive
265	Euphorbiaceae	*Euphorbia hirta*	Invasive
266	Amaranthaceae	*Gomphrena serrata*	Invasive
267	Poaceae	*Imperata cylindrica*	Invasive
268	Convolvulaceae	*Ipomoea carnea*	Invasive
269	Convolvulaceae	*Ipomoea nil*	Invasive

Sl. No.	Family	Scientific Name	Status
270	Convolvulaceae	*Ipomoea pes-tigridis*	Invasive
271	Convolvulaceae	*Ipomoea quamoclit*	Invasive
272	Verbenaceae	*Lantana camara*	Invasive
273	Fabaceae	*Leucaena leucocephala*	Invasive
274	Malvaceae	*Malvastrum coromandelianum*	Invasive
275	Martyniaceae	*Martynia annua*	Invasive
276	Malvaceae	*Melochia corchorifolia*	Invasive
277	Nyctaginaceae	*Mirabilis jalapa*	Invasive
278	Cactaceae	*Opuntia stricta*	Invasive
279	Oxalidaceae	*Oxalis corniculata*	Invasive
280	Asteraceae	*Parthenium hysterophorus*	Invasive
281	Solanaceae	*Physalis angulata*	Invasive
282	Portulacaceae	*Portulaca oleracea*	Invasive
283	Polygonaceae	*Rumex dentatus*	Invasive
284	Salviniaceae	*Salvinia molesta*	Invasive
285	Fabaceae	*Sesbania bispinosa*	Invasive
286	Malvaceae	*Sida acuta*	Invasive
287	Solanaceae	*Solanum nigrum*	Invasive
288	Solanaceae	*Solanum viarum*	Invasive
289	Linderniaceae	*Torenia fournieri*	Invasive
290	Zygophyllaceae	*Tribulus terrestris*	Invasive
291	Asteraceae	*Tridax procumbens*	Invasive
292	Malvaceae	*Triumfetta rhomboidea*	Invasive
293	Typhaceae	*Typha angustifolia*	Invasive
294	Malvaceae	*Urena lobata*	Invasive
295	Asteraceae	*Xanthium strumarium*	Invasive
296	Asteraceae	*Youngia japonica*	Invasive
297	Fabaceae	*Prosopis juliflora*	Invasive
298	Asteraceae	*Erigeron canadensis*	Invasive
299	Asteraceae	*Ageratum houstonianum*	Invasive
300	Apiaceae	*Heracleum lanatum*	Invasive
301	Urticaceae	*Urtica dioica*	Invasive
302	Fabaceae	*Senna tora*	Invasive
303	Euphorbiaceae	*Ricinus communis*	Invasive
304	Lamiaceae	*Mesosphaerum suaveolens*	Invasive

Table 11: Butterfly species list for Indicator 6

Sl. No.	Family	Common Name	Scientific Name
1	Hesperidae	Common Banded Awl	*Hasora chromus*
2	Hesperidae	Indian Grizzled Skipper	*Spialia galba*
3	Hesperidae	Banana Skipper	*Erionota torus*
4	Hesperidae	Indian Palm Bob	*Suastus gremius*
5	Hesperidae	Ceylon Swift	*Parnara bada*
6	Hesperidae	Bevan's Swift	*Borbo bevani*
7	Hesperidae	Small Branded Swift	*Pelopidas mathias*
8	Hesperidae	Yellowspot Swift	*Polytremis eltola*
9	Hesperidae	Golden Angle	*Caprona ransonnettii*
10	Hesperidae	Common Redeye	*Matapa aria*
11	Papilionidae	Common Mormon	*Papilio polytes*
12	Papilionidae	Lime Butterfly	*Papilio demoleus*
13	Papilionidae	Common Mime	*Chilasa clytia*
14	Papilionidae	Common Bluebottle	*Graphium sarpedon*
15	Papilionidae	Common Jay	*Graphium doson*
16	Pieridae	Common Gull	*Cepora nerissa*
17	Pieridae	Common Jezebel	*Delias eucharis*
18	Pieridae	White Orangetip	*Ixias marianne*
19	Pieridae	Yellow Orangetip	*Ixias pyrene*
20	Pieridae	Mottled Emigrant	*Catopsilia pyranthe*
21	Pieridae	Common Emigrant	*Catopsilia pomona*
22	Pieridae	Common Grass Yellow	*Eurema hecabe*
23	Lycaenidae	Bright Sunbeam	*Curetis bulis*
24	Lycaenidae	Common Lineblue	*Prosotas nora*
25	Lycaenidae	Tailless Lineblue	*Prosotas dubiosa*
26	Lycaenidae	Common Cerulean	*Jamides celeno*
27	Lycaenidae	Dark Cerulean	*Jamides bochus*
28	Lycaenidae	Forgetmenot.	*Catochrysops strabo*
29	Lycaenidae	Zebra Blue	*Leptotes plinius*
30	Lycaenidae	Dark Grass Blue	*Zizeeria karsandra*
31	Lycaenidae	Pale Grass Blue	*Pseudozizeeria maha*
32	Lycaenidae	Lesser Grass Blue	*Zizina otis*
33	Lycaenidae	Black-spotted Pierrot	*Tarucus balkanicus*
34	Lycaenidae	Striped Pierrot	*Tarucus nara*
35	Lycaenidae	Hazara Pierrot	*Tarucus hazara*
36	Lycaenidae	Indian Cupid	*Everes lacturnus*
37	Lycaenidae	Red Pierrot	*Talicada nyseus*
38	Lycaenidae	Bright Babul Blue	*Azanus ubaldus*
39	Lycaenidae	Dull Babul Blue	*Azanus uranus*
40	Lycaenidae	Common Hedge Blue	*Acytolepis puspa*
41	Lycaenidae	Dusky Hedge Blue	*Oreolyce vardhana*
42	Lycaenidae	Gram Blue	*Euchrysops cnejus*
43	Lycaenidae	Small Grass Jewel	*Freyeria putli*

Sl. No.	Family	Common Name	Scientific Name
44	Lycaenidae	Plains Cupid	*Luthrodes pandava*
45	Lycaenidae	Common Silverline	*Spindasis vulcanus*
46	Lycaenidae	Common Shot Silverline	*Spindasis ictis*
47	Lycaenidae	Large Oakblue	*Arhopala amantes*
48	Lycaenidae	Common Acacia Blue	*Surendra quercetorum*
49	Lycaenidae	Silverstreak Blue	*Iraota timoleon*
50	Lycaenidae	Common Onyx	*Horaga onyx*
51	Lycaenidae	Brown Onyx	*Horaga viola*
52	Lycaenidae	Plains Blue Royal	*Tajuria jehana*
53	Lycaenidae	Cornelian	*Deudorix epijarbas*
54	Lycaenidae	Common Guava Blue	*Virachola isocrates*
55	Lycaenidae	Slate Flash	*Rapala manea*
56	Lycaenidae	Indian Red Flash	*Rapala iarbus*
57	Riodinidae	Double-banded Judy	*Abisara bifasciata*
58	Nymphalidae	Blue Tiger	*Tirumala limniace*
59	Nymphalidae	Common Tiger	*Danaus genutia*
60	Nymphalidae	Striped Blue Crow	*Euploea mulciber*
61	Nymphalidae	Common Crow	*Euploea core*
62	Nymphalidae	Common Palmfly	*Elymnias hypermnestra*
63	Nymphalidae	Bamboo Treebrown	*Lethe europa*
64	Nymphalidae	Common Bushbrown	*Mycalesis perseus*
65	Nymphalidae	Dark-branded Bushbrown	*Mycalesis mineus*
66	Nymphalidae	Common Threering	*Ypthima asterope*
67	Nymphalidae	Jewel Fivering	*Ypthima lisandra*
68	Nymphalidae	Common Castor	*Ariadne merione*
69	Nymphalidae	Common Jester	*Symbrenthia lilaea*
70	Nymphalidae	Yellow Pansy	*Junonia hierta*
71	Nymphalidae	Blue Pansy	*Junonia orithya*
72	Nymphalidae	Lemon Pansy	*Junonia lemonias*
73	Nymphalidae	Chocolate Soldier	*Junonia iphita*
74	Nymphalidae	Orange Oakleaf	*Kallima inachus*
75	Nymphalidae	Danaid Eggfly	*Hypolimnas misippus*
76	Nymphalidae	Pallas's Sailer	*Neptis sappho*
77	Nymphalidae	Chestnut-streaked Sailer	*Neptis jumbah*
78	Nymphalidae	Common Sergeant	*Athyma perius*
79	Nymphalidae	Commander	*Moduza procris*
80	Nymphalidae	Common Baron	*Euthalia aconthea*
81	Nymphalidae	Tabby	*Pseudergolis wedah*
82	Nymphalidae	Common Nawab	*Polyura athamas*
83	Nymphalidae	Anomalous Nawab	*Polyura agraria*
84	Nymphalidae	Black Rajah	*Charaxes solon*
85	Nymphalidae	Tawny Coster	*Acraea violae*

Sl. No.	Family	Common Name	Scientific Name
86	Nymphalidae	Common Leopard	*Phalanta phalanta*
87	Nymphalidae	Angled Castor	*Ariadne aridone*
88	Nymphalidae	Double-brnaded Crow	*Euploea sylvester*
89	Nymphalidae	Common Beak	*Lebythea lepita*
90	Nymphalidae	Dark Evening Brown	*Melanitis phedima*
91	Nymphalidae	Common Fourring	*Ypthima huebneri*
92	Nymphalidae	Himalayan Tabby	*Pseudergolis wedah*
93	Papilionidae	Paris Peacock	*Papilio paris*
94	Pieridae	Lemon Emigrant	*Cataopsilia crocale*

Table 12: Reptiles list for Indicator 7

Sl. No.	Family	Common Name	Scientific Name
1	Gekkonidae	Brook's house gecko	*Hemidactylus brookii*
2	Gekkonidae	Yellow-green house gecko	*Hemidactylus flaviviridis*
3	Gekkonidae	Asian house gecko	*Hemidactylus frenatus*
4	Agamidae	Indian garden lizard	*Calotes versicolor*
5	Scincidae	Striped grass skink	*Mabuya dissimilis*
6	Scincidae	Bronze grass skink	*Mabuya macularia*
7	Varanidae	Indian monitor lizard	*Varanus bengalensis*
8	Boidae	Common sand boa	*Gongylophis conicus*
9	Boidae	Earth boa/Red boa	*Eryx Johnii*
10	Elapidae	Common krait	*Bungarus caeruleus*
11	Elapidae	Common Indian cobra	*Naja naja*
12	Colubridae	Buffed striped keelback	*Amphiesma stolatum*
13	Colubridae	Rat snake	*Ptyas mucosa*
14	Colubridae	Banded kukri snake	*Oligodon amensis*
15	Typhlopidae	Brahminy worm snake	*Ramphotyphlops braminus*
16	Viperidae	Russell's viper	*Daboia russelii*

Table 13: Mammal list for Indicator 8

Sl. No.	Family	Common Name	Scientific Name
1	Vespertilionidae	Mount Popa pipistrelle	*Pipistrellus paterculus*
2	Muridae	Indian gerbil	*Tatera indica*
3	Hyaenidae	Striped hyena	*Hyaena hyaena*
4	Muridae	Little Indian field mouse	*Mus booduga*
5	Muridae	House mouse	*Mus musculus*
6	Muridae	Lesser bandicoot rat	*Bandicota bengalensiswardii*
7	Muridae	Himalayan rat	*Rattus pyctoris*
8	Cervidae	Indian muntjac	*Muntiacus vaginalis*
9	Muridae	Chestnut rat	*Niviventer fulvescens*
10	Manidae	Indian pangolin	*Manis crassicaudata*
11	Vespertilionidae	Grey long-eared bat	*Plecotus austriacus*
12	Herpestidae	Small Indian mongoose	*Herpestes auropunctatus*

Sl. No.	Family	Common Name	Scientific Name
13	Muridae	Black rat	*Rattus rattus*
14	Viverridae	Small Indian civet	*Viverricula indica*
15	Vespertilionidae	Javan pipistrelle	*Pipistrellus javanicus babu*
16	Megadermatidae	Greater false vampire	*Megaderma lyra*
17	Ursidae	Asian black bear	*Ursus thibetanus*
18	Canidae	Golden jackal	*Canis aureus*
19	Vespertilionidae	Indian pipistrelle	*Pipistrellus coromandra*
20	Muridae	Earth-colored mouse	*Mus terricolor*
21	Sciuridae	Northern palm squirrel	*Funambulus pennantii*
22	Canidae	Red fox	*Vulpes vulpes*
23	Muridae	House mouse	*Mus musculus*
24	Rhinolophidae	Greater horseshoe bat	*Rhinolophus ferrumequinum*
25	Pteropodidae	Indian flying fox	*Pteropus giganteus leucocephalus*
26	Cercopithecidae	Rhesus macaque	*Macaca mulatta*
27	Soricidae	House shrew or Grey musk shrew	*Suncus murinus*
28	Vespertilionidae	Leisler's bat	*Nyctalus leisleri*
29	Herpestidae	Grey mongoose	*Herpestes edwardsii*
30	Felidae	Leopard cat	*Prionailurus bengalensis trevelyani*
31	Leporidae	Desert hare	*Lepus tibetanus*
32	Vespertilionidae	Hutton's tube-nosed bat	*Murina huttoni huttoni*
33	Hystricidae	Indian porcupine	*Hystrix indica*
34	Mustelidae	Yellow-throated marten	*Martes flavigula*
35	Soricidae	Eurasian pygmy shrew	*Sorex minutus*
36	Felidae	Leopard	*Panthera pardus*
37	Soricidae	House shrew or Grey musk shrew	*Suncus murinus*
38	Vespertilionidae	Hemprich's long-eared bat	*Otonycteris hemprichii*
39	Pteropodidae	Leschenault's rousette	*Rousettus leschenaultii leschenaultii*
40	Viverridae	Asian palm civet	*Paradoxurus hermaphroditus*
41	Pteropodidae	Greater short-nosed fruit bat	*Cynopterus sphinx*
42	Mustelidae	Himalayan stoat or Ermine	*Mustela erminea*
43	Mustelidae	Siberian weasel	*Mustela sibirica*
44	Mustelidae	Mountain weasel	*Mustela altaica*
45	Pteropodidae	Indian flying fox	*Pteropus giganteus leucocephalus*

ANNEXURE 3 – LIST OF PARKS IN JAMMU

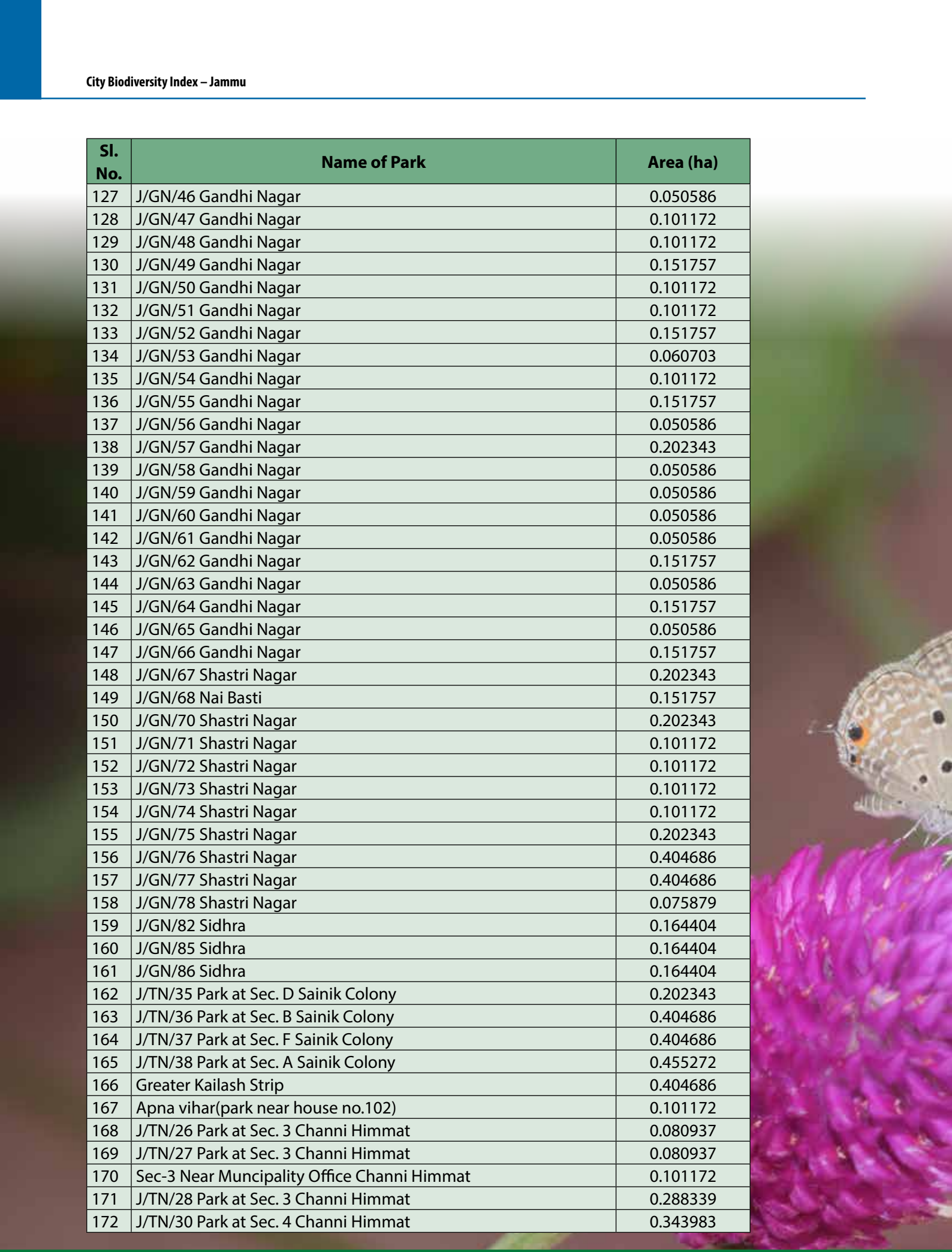
Table 14: List of Parks in Jammu city

Sl. No.	Name of Park	Area (ha)
1	Park at Dewana Mandir park Kachi Chawni	0.075879
2	Strip at residence Quarters Judges Amphalla	0.050586
3	Roop Nagar Park Sector No. 6 H.No. 129	0.303515
4	Roop Nagar Sector No. 6 H.No. 20	0.202343
5	Park at Rajpura Mangrotrian	0.202343
6	Krishana Nagar Park	0.202343
7	Lohan Paloura Park	0.252929
8	Municipal Park Karan Nagar	0.050586
9	Park at Top Paloura	0.455272
10	Plourika park near Raina School	0.202343
11	Bhagwati Nagar strip	0.252929
12	R.R.L. strip	0.050586
13	Secretariat Park, Near Rameshwar Temple	0.075879
14	Municipal Park, Moh. Naraina	0.046033
15	Municipal Park, Resham Ghar in (Ambedkar Community Hall)	0.145181
16	Shiva ji Park, Sarwal colony	0.057668
17	Green Belt Park, Sarwal Colony	0.089031
18	Master Devi Chand Park, Rehari Colony	0.207402
19	Muncipal Mridula Park, Sera Bhai behind Arya Samaj Mandir Bakshi Nagar	0.093584
20	Muncipal Park, Behind Muncipal park market near J&K Bank Bakshi Nagar	0.027822
21	Municipal Park Gurah Bakshi Nagar	0.004553
22	Municipal Park Rama Lane TalabTillo Near Nitco Lane	0.046033
23	Municipal Park Near Jaswant Plaza, TalabTillo	0.241294
24	Buta Nagar Park opp Janipur Police Station	0.073855
25	Roop Nagar Municipal Park Sector-4,Upper Roop Nagar	0.120394
26	Muthi Municipal Park Ist Lower Roop Nagar Main Road	0.092572
27	Muthi Municipal Park IInd Sector-2Lower Roop Nagar opp.JDA market lane	0.097125
28	Muthi Municipal Park IIIrd Sector 4, Lower Roop Nagar	0.120394
29	Lower Muthi Park 4th Sector-7 Lower Roop Nagar	0.102183
30	Dogra Sheed Samarak Park near Petrol Pump Amphalla	0.025293
31	Kaleeth mohalla municipal Park Hari Market	0.239776
32	Gujjar Nagar Municipal Park Near Jogi Gate Gujjar Nagar Janipur colony parks (72no. parks)	0.025293
33	Janipur Colony Park (72) no. parks in w.no.37	0.027822
34	Janipur Colony Park (2)	0.027822
35	Janipur Colony Park (3)	0.022764
36	Janipur Colony Park (4)	0.026558

Sl. No.	Name of Park	Area (ha)
37	Janipur Colony Park (5)	0.031616
38	Janipur Colony Park (6)	0.024028
39	Janipur Colony Park (7)	0.042998
40	Janipur Colony Park (8)	0.063232
41	Janipur Colony Park (9)	0.03541
42	Janipur Colony Park (10)	0.065761
43	Janipur Colony Park (11)	0.012646
44	Janipur Colony Park (12)	0.015176
45	Janipur Colony Park (13)	0.012646
46	Janipur Colony Park (14)	0.012646
47	Janipur Colony Park (15)	0.055644
48	Janipur Colony Park (16)	0.040469
49	Janipur Colony Park (17)	0.030351
50	Janipur Colony Park (18)	0.030351
51	Janipur Colony Park (19)	0.03541
52	Janipur Colony Park (20)	0.032881
53	Janipur Colony Park (21)	0.040469
54	Janipur Colony Park (22)	0.026558
55	Janipur Colony Park (23)	0.022764
56	Janipur Colony Park (24)	0.020234
57	Janipur Colony Park (25)	0.017705
58	Janipur Colony Park (26)	0.031616
59	Janipur Colony Park (27)	0.032881
60	Janipur Colony Park (28)	0.032881
61	Janipur Colony Park (29)	0.03541
62	Janipur Colony Park (30)	0.040469
63	Janipur Colony Park (31)	0.025293
64	Janipur Colony Park (32)	0.030351
65	Janipur Colony Park (33)	0.026558
66	Janipur Colony Park (34)	0.048056
67	Janipur Colony Park (35)	0.030351
68	Janipur Colony Park (36)	0.040469
69	Janipur Colony Park (37)	0.021499
70	Janipur Colony Park (38)	0.032881
71	Janipur Colony Park (39)	0.032881
72	Janipur Colony Park (40)	0.027822
73	Janipur Colony Park (41)	0.032881
74	Janipur Colony Park (42)	0.015176
75	Janipur Colony Park (43)	0.015176
76	Janipur Colony Park (44)	0.040469
77	Janipur Colony Park (45)	0.126464
78	Janipur Colony Park (46)	0.048056
79	Janipur Colony Park (47)	0.050586
80	Janipur Colony Park (48)	0.027822
81	Janipur Colony Park (49)	0.065761

Sl. No.	Name of Park	Area (ha)
82	Janipur Colony Park (50)	0.037939
83	Janipur Colony Park (51)	0.025293
84	Janipur Colony Park (52)	0.049321
85	Janipur Colony Park (53)	0.027822
86	Janipur Colony Park (54)	0.031616
87	Janipur Colony Park (55)	0.045527
88	Janipur Colony Park (56)	0.030351
89	Janipur Colony Park (57)	0.027822
90	Janipur Colony Park (58)	0.037939
91	Durga Nagar Park	0.075879
92	J/GN/03, Gandhi Nagar	0.252929
93	J/GN/09 Gandhi Nagar	0.354100
94	J/GN/11 Gandhi Nagar	0.303515
95	J/GN/12 Gandhi Nagar	0.202343
96	J/GN/13 Gandhi Nagar	0.303515
97	J/GN/14 Gandhi Nagar	0.202343
98	J/GN/15 Gandhi Nagar	0.202343
99	J/GN/16 Gandhi Nagar	0.455272
100	J/GN/17 Gandhi Nagar	0.252929
101	J/GN/18 Gandhi Nagar	0.151757
102	J/GN/19 Gandhi Nagar	0.354100
103	J/GN/21 Gandhi Nagar	0.303515
104	J/GN/22 Gandhi Nagar	0.483094
105	J/GN/24 Gandhi Nagar	0.202343
106	J/GN/25 Gandhi Nagar	0.151757
107	J/GN/26 Gandhi Nagar	0.202343
108	J/GN/27 Gandhi Nagar	0.101172
109	J/GN/28 Gandhi Nagar	0.151757
110	J/GN/29 Gandhi Nagar	0.113818
111	J/GN/30 Gandhi Nagar	0.252929
112	J/GN/31 Gandhi Nagar	0.202343
113	J/GN/32 Gandhi Nagar	0.151757
114	J/GN/33 Gandhi Nagar	0.101172
115	J/GN/34 Gandhi Nagar	0.075879
116	J/GN/35 Gandhi Nagar	0.151757
117	J/GN/36 Gandhi Nagar	0.101172
118	J/GN/37 Gandhi Nagar	0.050586
119	J/GN/38 Gandhi Nagar	0.101172
120	J/GN/39 Gandhi Nagar	0.055644
121	J/GN/40 Gandhi Nagar	0.063232
122	J/GN/41 Gandhi Nagar	0.063232
123	J/GN/42 Gandhi Nagar	0.202343
124	J/GN/43 Gandhi Nagar	0.075879
125	J/GN/44 Gandhi Nagar	0.202343
126	J/GN/45 Gandhi Nagar	0.075879

Sl. No.	Name of Park	Area (ha)
127	J/GN/46 Gandhi Nagar	0.050586
128	J/GN/47 Gandhi Nagar	0.101172
129	J/GN/48 Gandhi Nagar	0.101172
130	J/GN/49 Gandhi Nagar	0.151757
131	J/GN/50 Gandhi Nagar	0.101172
132	J/GN/51 Gandhi Nagar	0.101172
133	J/GN/52 Gandhi Nagar	0.151757
134	J/GN/53 Gandhi Nagar	0.060703
135	J/GN/54 Gandhi Nagar	0.101172
136	J/GN/55 Gandhi Nagar	0.151757
137	J/GN/56 Gandhi Nagar	0.050586
138	J/GN/57 Gandhi Nagar	0.202343
139	J/GN/58 Gandhi Nagar	0.050586
140	J/GN/59 Gandhi Nagar	0.050586
141	J/GN/60 Gandhi Nagar	0.050586
142	J/GN/61 Gandhi Nagar	0.050586
143	J/GN/62 Gandhi Nagar	0.151757
144	J/GN/63 Gandhi Nagar	0.050586
145	J/GN/64 Gandhi Nagar	0.151757
146	J/GN/65 Gandhi Nagar	0.050586
147	J/GN/66 Gandhi Nagar	0.151757
148	J/GN/67 Shastri Nagar	0.202343
149	J/GN/68 Nai Basti	0.151757
150	J/GN/70 Shastri Nagar	0.202343
151	J/GN/71 Shastri Nagar	0.101172
152	J/GN/72 Shastri Nagar	0.101172
153	J/GN/73 Shastri Nagar	0.101172
154	J/GN/74 Shastri Nagar	0.101172
155	J/GN/75 Shastri Nagar	0.202343
156	J/GN/76 Shastri Nagar	0.404686
157	J/GN/77 Shastri Nagar	0.404686
158	J/GN/78 Shastri Nagar	0.075879
159	J/GN/82 Sidhra	0.164404
160	J/GN/85 Sidhra	0.164404
161	J/GN/86 Sidhra	0.164404
162	J/TN/35 Park at Sec. D Sainik Colony	0.202343
163	J/TN/36 Park at Sec. B Sainik Colony	0.404686
164	J/TN/37 Park at Sec. F Sainik Colony	0.404686
165	J/TN/38 Park at Sec. A Sainik Colony	0.455272
166	Greater Kailash Strip	0.404686
167	Apna vihar(park near house no.102)	0.101172
168	J/TN/26 Park at Sec. 3 Channi Himmat	0.080937
169	J/TN/27 Park at Sec. 3 Channi Himmat	0.080937
170	Sec-3 Near Muncipality Office Channi Himmat	0.101172
171	J/TN/28 Park at Sec. 3 Channi Himmat	0.288339
172	J/TN/30 Park at Sec. 4 Channi Himmat	0.343983



Sl. No.	Name of Park	Area (ha)
173	J/TN/31 Park at Sec. 4 Channi Himmat	0.404686
174	J/TN/32 Park at Sec. 4 Channi Himmat	0.263046
175	J/TN/33 Park at Sec. 5 Channi Himmat	0.445155
176	J/TN/34 Park at Sec. 7 Channi Himmat	0.404686
177	J/TN/07 Park at Sec. 1 Trikuta Nagar	0.404686
178	J/TN/08 Park at Sec. 1 Trikuta Nagar	0.202343
179	J/TN/09 Park at Sec. 1 Trikuta Nagar	0.202343
180	J/TN/10 Park at Sec. 2 Trikuta Nagar	0.202343
181	J/TN/11 Park at Sec. 3 Trikuta Nagar	0.101172
182	J/TN/12 Park at Sec. 3 Trikuta Nagar	0.252929
183	J/TN/13 Park at Sec. 4 Trikuta Nagar	0.050586
184	J/TN/14 Park at Sec. 4 Trikuta Nagar	0.101172
185	J/TN/15 Park at Sec. 5 Trikuta Nagar	0.252929
186	J/TN/16 Park at Sec. 6 Trikuta Nagar	0.151757
187	J/TN/17 Park at Sec. 7 Trikuta Nagar	0.151757
188	J/TN/18 Park at Sec. 8 Trikuta Nagar	0.151757
189	J/TN/19 Park at Sec. 9 Trikuta Nagar	0.202343
190	J/TN/20 Park at Sec. 3 Trikuta Nagar	0.101172
191	J/TN/2sec26, Trikuta Nagar	0.101172
192	Apna vihar (park near house no.10)	0.101172
193	Apna vihar (park near house no.27)	0.050586
194	J/TN/1 Shaheed Bhagat Singh Park,Digiana	0.411262
195	J/TN/2 Jeevan Nagar Park & Strip, Digiana	0.429979
196	J/TN/5 Gangyal Park	0.156816
197	J/TN/6 Babliana Gangyal	0.192226
198	Municipal Park Gorkha Nagar Bahu Fort	0.072338
199	Maharaja Hari Singh Park Opp. Police Check Post, Bawa Road	0.011129
200	Lt. Gen. Bikram Singh Park Near Tawi Bridge	0.010117
201	Rampura Park Nai Basti	0.075879
202	Hiranand Municipal Park Opp. Cremation Ground, Channi Himmat	0.081949
203	Municipal Park Near Nallah side (in which high voltage pole fixed)	0.016693
204	Municipal Park Sector 2, Near Nallah side (in which Tube well), Channi Himmat	0.015682
205	Municipal Park Sector 1/A, opp. H. No. 47 Channi Himmat, Near Nallah Side	0.015682
206	Municipal Park On the backside of Ram Leela Ground, Channi Himmat	0.016693
207	Major Ajay Singh Jasrotia Municipal Park Sector C, Sainik Colony	2.408894
208	Municipal Park Sector G, Near Panch Mandir Sainik Colony	0.020234
209	Municipal Park Sector E Opp. H. No. 499 (Bobby House), Sainik Colony	0.020234
210	Municipal Park Near Police Check Post, Greater Kailash	0.193238
211	Municipal Park Opp. Club, Main Road, Greater Kailash	0.016693
212	Municipal Park Opp. XEN House, Sainik Colony	0.016693

Sl. No.	Name of Park	Area (ha)
213	Municipal Park Near Dushera Ground Back side of Apsara	0.055644
214	Recreation Park, Kunjwani Onway to Sainik Colony, Kunjwani	0.232694
215	Recreation Park, Kunjwani Onway to Punjab side, Kunjwani	0.015176
216	Recreation Park, Kunjwani Onway to Jammu side, Kunjwani	0.011129
217	Municipal Park, Kunjwani Inside Mohalla, Kunjwani	0.009105
218	Municipal Park, Kunjwani Inside Mohalla, Kunjwani	0.002529
219	Rajinder Park	0.050586
220	Park at Jourian	0.151757
221	Jio Pota Park	0.151757
222	Arnia Park	0.471459
223	Bishnah Strip	0.404686
224	Karna Nagar Park	0.050586
225	Rajpura Park	0.202343
226	Zanana Park Talab Tillo Jammu	0.657615
227	B.C. Park	0.708201
228	Rani Park	0.708201
229	Darbar Garh Park	0.657615
230	Mubarak Mandi Park	1.112887
231	Nagrota Park	0.505858
232	Zanana Park Dogra Hall	1.112887
233	New Sectt Park	0.657615
234	Shivaji Park	0.303515
235	Rajinder Park	2.023430
236	J/GN/05	0.505858
237	J/GN/07	0.657615
238	J/GN/08	0.657615
239	J/GN/10	0.758786
240	J/GN/01	0.910544
241	J/GN/02	0.910544
242	J/GN/04	0.657615
243	J/GN/69	0.505858
244	J/GN/20	0.505858
245	J/GN/23	0.809372
246	Govt. Guest House	5.255860
247	Channi Himmat Park	0.607029
248	Digiana Ashram	0.505858
249	Akali Kour Strip	0.505858
250	Bagh -e - Bahu Garden	9.105436
251	Bhour Camp Garden	28.47978
	Total (Hectare)	**90.55381**

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