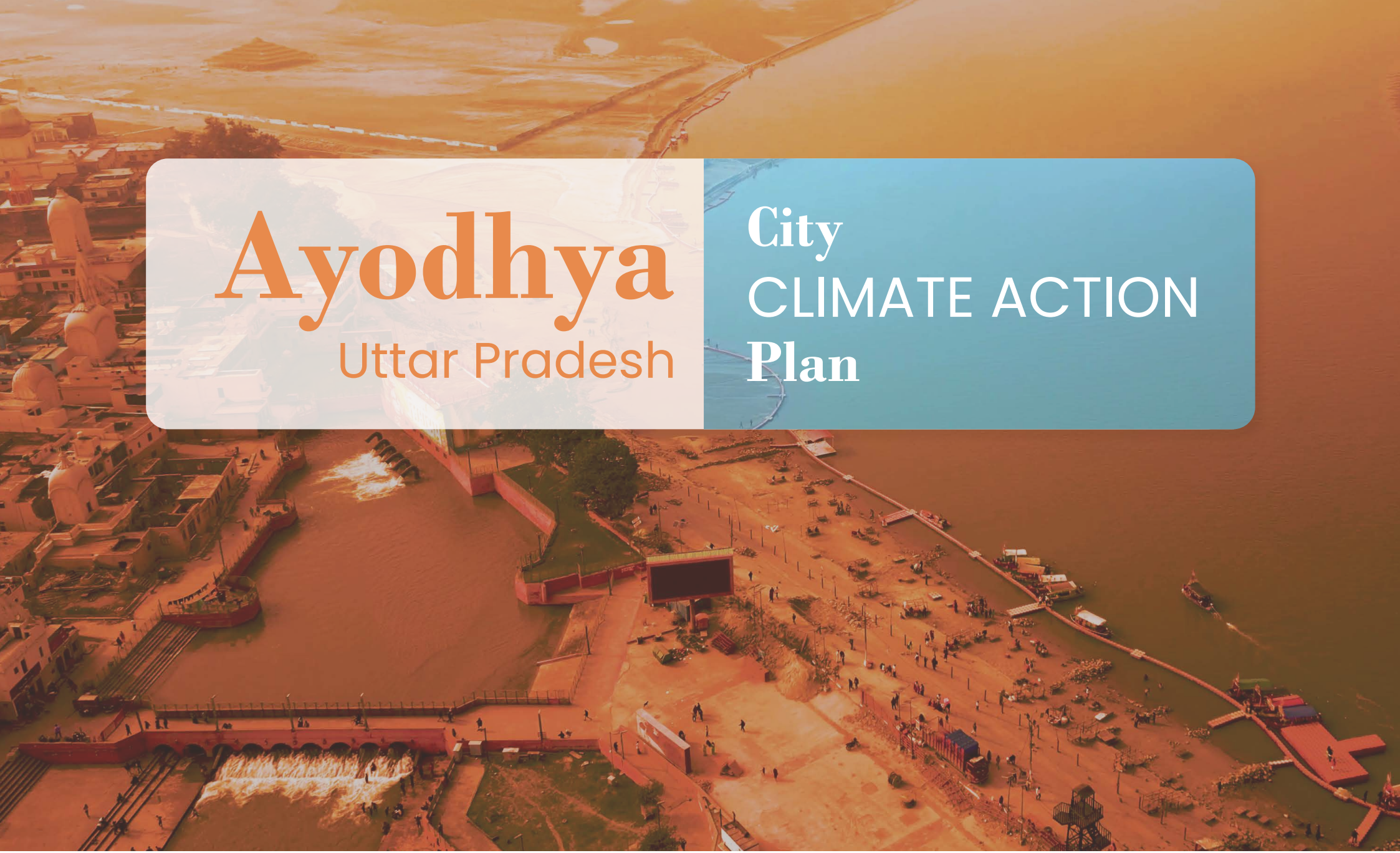

Ayodhya

Uttar Pradesh

City CLIMATE ACTION Plan

उत्तर प्रदेश सरकार

जलवायु सहन अभियान

उत्तर प्रदेश जलवायु परिवर्तन प्राधिकरण

नगर निगम अयोध्या

उन्नयन • सेवा • समर्पण

अ वि प्रा

अयोध्या विकास प्राधिकरण

AYODHYA DEVELOPMENT AUTHORITY

VASUDHA FOUNDATION

Green ways for a good earth!

Published by

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Department of Environment, Forest and Climate Change, Government of Uttar Pradesh
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Vasudha Foundation

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Ayodhya
Uttar Pradesh

City CLIMATE ACTION Plan

Mr. Chandra Vijay Singh, IAS

District Magistrate (DM), Ayodhya

Chandra Vijay Singh, IAS
District Magistrate
District Ayodhya

Date: 12.11.2024

-: Message: -

I am pleased to present the Climate Action Plan of Ayodhya City, a significant step toward a sustainable and resilient future. Ayodhya, rich in cultural heritage and spiritual significance, faces unique environmental challenges requiring immediate attention and collective action.

Uttar Pradesh is leading by example in integrating climate priorities into development planning at the subnational level through initiatives aimed at localising climate action at the Gram Panchayat, city, and district levels.

Ayodhya district is also a flagbearer of this commitment, as evidenced by the targets achieved under the Solar City Ayodhya program. The Climate Action Plan of Ayodhya City represents another step in our journey toward India achieving its net zero target by 2070.

This plan not only reflects our commitment to addressing climate change but also aligns seamlessly with ongoing national programs spearheaded by the Government of India and the initiatives of the Government of Uttar Pradesh. The Climate Action Plan of Ayodhya City is in accordance with the State Action Plan on Climate Change (SAPCC) 2.0, which provides a framework for the climate activities outlined in this document.

Through this City Climate Action Plan, we aim to enhance urban resilience, reduce greenhouse gas emissions, and protect our natural resources while contributing to national climate objectives. The strategies incorporate renewable energy adoption, waste management improvements, and the promotion of green spaces, all of which align with the leadership and vision of both the Central and State Government.

I would like to thank the **Department of Environment, Forest, and Climate Change, Government of Uttar Pradesh**. for envisioning and guiding this plan, and **Vasudha Foundation, New Delhi,** for undertaking its development in consultation with various line departments and other stakeholders.

I urge all citizens to embrace this plan, participate actively in its implementation, and contribute to our shared goal of a sustainable future. Together, we can preserve the beauty and sanctity of Ayodhya while ensuring a thriving environment for all.

(Chandra Vijay Singh)

Mr. Santosh Kumar Sharma, IAS

CEO, Shri Ayodhya Ji Teerth Vikas Parishad &
Municipal Commisioner, Ayodhya Nagar Nigam

Santosh Kumar Sharma IAS
CEO, Shri Ayodhya Ji Teerth Vikas Parishad
Municipal Commissioner,
Municipal Corporation, Ayodhya

Ref No- 1305/NNAYO/2024
Date: 6/11/2024.

-: Message: -

Climate change is a pressing concern that requires collective action and prompt initiatives. The Government of India is committed to this cause and has established various policies and programs to help the country achieve its net-zero target by 2070.

It is crucial for administrations at all levels to commence climate action immediately and contribute effectively to national targets. Localising climate action is essential to ensure efforts are made across various levels, fostering resilient communities. For Ayodhya, balancing climate commitments with urban development is especially important, given the rapid infrastructure expansion aimed at making Ayodhya a global tourism destination. The Hon'ble Chief Minister envisions Ayodhya as a spiritual capital, with climate action thoughtfully integrated into this vision to protect and enhance the city's unique heritage and environment. Considering the increasing impacts of climate change, proactive climate action is crucial to ensure Ayodhya's cultural legacy is preserved for future generations.

While state-level policies and initiatives are being implemented, I am pleased to introduce the City Climate Action Plan (CCAP) of Ayodhya, prepared under the guidance of the Department of Environment, Forest, and Climate Change, Uttar Pradesh, with technical support from the Vasudha Foundation, New Delhi. This Action Plan has been developed in consultation with the Ayodhya Nagar Nigam and other stakeholders. It provides a comprehensive assessment of climate variability, projections, sectoral greenhouse gas emissions, and climate change drivers in the city.

Based on this assessment, the plan identifies various local interventions that align with state and national policies and programs. It also incorporates a comprehensive set of recommendations in alignment with the Sustainable Development Goals (SDGs) for various climate-related sectors and environmental issues in Ayodhya.

I commend the extensive efforts made toward developing the CCAP of Ayodhya City. This action plan serves as a roadmap for mainstreaming climate action in alignment with the city's development priorities.

(Santosh Kumar Sharma)
6/11/2024
नगर आयुक्त
नगर निगम अयोध्या

Mr. Ashwini Kumar Pandey, IAS

Vice Chairman, Ayodhya Development Authority

अयोध्या विकास प्राधिकरण

सिविल लाइन, चौदह कोसी परिक्रमा मार्ग, अयोध्या – 224001

www.ayodhyada.in vcafda@gmail.com, vcada@ayodhyada.com

Letter No: 4491 /ADA/2024-25 Date: 08-11-2024

MESSAGE

I am pleased to share the first Climate Action Plan of Ayodhya City. With the city's potential for exponential growth and its significance as a key player in the country's tourism landscape, Ayodhya is uniquely positioned to integrate sustainability principles into its future development. The city has been selected as the first model Solar City in Uttar Pradesh and has made remarkable strides in adopting renewable energy solutions.

The initiatives of the Ayodhya Development Authority (ADA) are aligned with the vision of creating a climate-smart Ayodhya. These include undertaking a high-resolution mapping of green spaces and a comprehensive heat stress mapping of the city, conducted with technical support from VITO (Flemish Research Organisation) and AKTU, as well as the development of the first of its kind, Vedic Sustainability Index, created in collaboration with Arahas Technologies Pvt Ltd. This index serves as a benchmark for tracking the city's sustainable progress. Additionally, ADA has launched the Green Ayodhya Fund, with the mission to enhance environmental sustainability through tree planting, green space development, and eco-friendly practices.

This Action Plan complements the ongoing initiatives and provides a roadmap for climate action across various key sectors. It is a comprehensive document that outlines sectoral priorities for climate action in Ayodhya, supported by greenhouse gas emissions estimates and detailed analyses of the region's climate variability and projections. It not only aims to mitigate the effects of climate change but also seeks to enhance the resilience and adaptive capacities of the region. With phase-wise targets that integrate climate responses into the city's planning and operations, the plan identifies various themes for action. Together, we can create a vibrant, eco-friendly city that honours our heritage while paving the way for a sustainable future.

I want to express my gratitude to the Department of Environment, Forest, and Climate Change, Uttar Pradesh, under whose guidance this plan has been prepared, and to the Vasudha Foundation for providing the technical support needed to develop it. I am hopeful that this plan will provide the direction necessary to make Ayodhya a resilient and climate-smart city.

Let us move forward with determination and hope as we embark on this vital journey toward climate action.

(Ashwini Kumar Pandey)
Vice Chairman
Ayodhya Development Authority
Ayodhya.

Mr. Pranav Jain, IFS

Divisional Forest Officer (DFO), Ayodhya

Pranav Jain, IFS
Divisional Forest Officer
Ayodhya

Date: 12.11.2024

-: Message: -

It gives me immense pleasure to present the City Climate Action Plan (CCAP) of Ayodhya, synthesised as an effort to systematically integrate forward-looking climate action into urban planning. This endeavour highlights Ayodhya's significance—not only as a cultural epicentre but also as a pivotal city in India's landscape.

Under the visionary leadership of the Hon'ble Chief Minister and the Government of Uttar Pradesh, the Department of Environment, Forest, and Climate Change has been working to localise climate action to enhance resilience and adaptive capacities while tackling emissions as well as providing co-benefits to communities at large. The state has made remarkable progress toward achieving the Sustainable Development Goals at the grassroots level. This is reflected in the development of District Climate Action Plans, Gram Panchayat Action Plans, and the Standard Operating Procedure and Framework for Development of Climate Smart Gram Panchayat Action Plans.

The plan uses a bottom-up approach to localise strategies leading to tailor-made solutions which are specific to the environmental, social and economic context of Ayodhya. This will ensure that our initiatives are both relevant and effective in the long term.

The plan has been developed in consultation with key stakeholders, including the Nagar Nigam of Ayodhya, the Ayodhya Development Authority, and various line departments. It also takes into account the unique climatic concerns of the region and how these are perceived by citizens. This collaborative approach has been essential for creating sustainable practices that not only address immediate concerns but also pave the way for long-term ecological balance.

I would like to thank the **Vasudha Foundation** for providing the technical support necessary to develop this plan, under the guidance of **the Department of Environment, Forest, and Climate Change, Government of Uttar Pradesh.**

This CCAP of Ayodhya underscores the city's importance in India's broader climate action efforts. My hope is that, together, we can create a resilient and greener future that honours our rich heritage while safeguarding our environment for generations to come. Let us work hand in hand to build a sustainable, climate-smart Ayodhya

(Pranav Jain)

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Executive Summary

Ayodhya is a key cultural destination in Uttar Pradesh, home to numerous places of religious interest. In recent years, the region has undergone transformational changes, owing to the various developmental initiatives spearheaded by the Government of Uttar Pradesh. With the ongoing efforts in Ayodhya towards climate action, including the outcomes achieved through the Solar City Ayodhya programmes (such as adoption of rooftop solar systems for residential and institutional buildings, solar trees, adoption of solar street lights), participatory greening initiatives leveraged through the Green Ayodhya Fund, development of city-level Thermal Cooling Action Plan and a Vedic City Sustainability Index, the region is making significant progress towards a sustainable future. However, the anticipated developments in the city necessitate continued action on this front. Ayodhya's population is projected to grow to 12 lakhs[1] by 2031, highlighting the need for a roadmap for assessing critical sectors and strengthening climate action at the city level.

Envisioned by the Department of Environment, Forest, and Climate Change, Uttar Pradesh, the Ayodhya City Climate Action Plan (CCAP) builds upon the priorities laid out in the State Action Plan on Climate Change (SAPCC) version 2.0. With this background, Ayodhya City Climate Action Plan aims to provide a roadmap to policy makers that aids the ongoing national and subnational efforts to contribute to India's net zero targets. It is a comprehensive strategy designed to address climate challenges and promote sustainable development across various sectors in the city, including energy, waste and wastewater management, tourism, rejuvenation of water bodies, and green spaces. The action plan has been developed with the intention to provide workable solutions and suggestive actions in line with the planned and ongoing developmental works in the city.

This action plan, therefore, takes a holistic view of the current policies and recommends steps that need to be taken in the short-, medium- and long-term to bring about the necessary changes that are in compliance with India's overall climate goals and commitments. The plan is structured into three phases: Phase I (2024-2027); Phase II (2028-2031); and Phase III (2032-2035).

Further, the suggested climate smart activities have tangible goals and targets which will help Ayodhya city to reduce greenhouse gas emissions, adopt low emission development trajectories, as well as build climate resilience. In addition to direct outcomes, co-benefits such as improved health, improved natural resource management, and improved socio-economic outcomes are also envisioned through the CCAP. It also lists the current policies, programmes and schemes for convergence and identifies concerned departments that can help streamline the actions.

1. The population projection is for an area of 133 sq. km, for which Master Plan 2031 has been prepared. However, the area under Ayodhya Development Authority has been proposed to extended to 873 sq. km. in part B. For this area, the projected population figure will increase. However, since the current CCAP has been prepared for the planning area as per Master Plan 2031, Part A, the given population figure has been considered.

Approach

Baseline assessment	■ Stakeholder Consultations: Interactions with district and city officials during various stages of plan preparations, including multi-stakeholder consultations. ■ Development of city profile with data highlights from relevant sectors (demography, industry, agriculture, climate, land use and land cover categorisation, water, waste management and sanitation, and natural resources).
Observed climate variability	Observed historic climate variability and future projections under different scenarios.
Carbon footprint	GHG emissions and drivers of climate change including direct drivers (emissions for various activities* in the year 2022).
Proposed spatial and detailed recommendations	Mapping of climate smart interventions for the city across sectors including solid waste management, urban cooling and green spaces, green mobility, and renewable energy.

**Activities include: Transport, electricity consumption, domestic and industrial wastewater, solid waste, rice cultivation, crop burning, fertiliser consumption, and livestock emissions.*

The Ayodhya City Climate Action Plan aims to mitigate the impacts of climate variability, reduce greenhouse gas (GHG) emissions, enhance the resilience of Ayodhya's infrastructure, and ensure a sustainable future for Ayodhya's growing population. Given the city's cultural, historical, and religious significance, the plan emphasises balancing development with environmental conservation. A few priority areas for immediate action in Ayodhya city are:

- Enhancing sustainable management of solid waste and improved at-source waste segregation, scale-up waste management infrastructure, and pilot decentralised organic waste management solutions.
- Harnessing renewable energy (RE) and energy efficient solutions to strive for self-reliant energy infrastructure, and develop Ayodhya as a model city.
- Implementing measures such as improving green cover and softscape urban landscapes to enhance thermal comfort.
- Revitalising current water sources and rejuvenating wetlands through nature-based solutions and participatory resource management.

The estimated carbon footprint of various activities in the city was ~4,76,146 tCO_2e in the year 2022. The action plan provides comprehensive, sector-wise recommendations from a climate perspective to help reduce and mitigate the anticipated GHG emissions from these activities. The CCAP is in alignment with India's NDC commitments as well as the priorities of the SAPCC 2.0.

01

The Approach and Context

The Ayodhya Climate Smart Action Plan has been prepared in consultation and engagement with a wide range of stakeholders, including key officials of the City and District Administration of Ayodhya, the Government of Uttar Pradesh, Ayodhya residents, and other stakeholders.

Towards making Ayodhya a model city, the action plan factors in various other studies and initiatives undertaken by various organisations, such as the Ayodhya Thermal Cooling Plan by Veto and the Vedic Sustainability Index for Ayodhya City undertaken by Arahaas. Further, it also factors in the vision for Ayodhya (Vision Ayodhya 2047) developed by the Ayodhya administration and the Government of Uttar Pradesh.

Further, the action plan is also based on the following:

a) A detailed climate variability analysis to ascertain temperature and rainfall patterns in the city from 1950 till date and future climate variability projections for the period up to 2100.
b) A detailed greenhouse gas (GHG) profile of Ayodhya, which captures the current GHG emissions from various activities taking place in the city.
c) An analysis of issues of concern in the city from a climate lens.
d) A set of recommendations designed to address key concerns while building upon the initiatives already proposed by the Government of Uttar Pradesh and the urban local body (ULB) level projects currently in the pipeline, enhancing Ayodhya City's climate-smart and climate resilient development.

02

Ayodhya Planning Area Profile

Ayodhya is a historical city of religious, cultural, and mythological significance. Known for rich heritage, the city attracts lakhs of pilgrims and tourists each year, especially with the construction of the Shree Ram Janam Bhoomi Mandir. The city is also undergoing rapid development, including initiatives focused on infrastructural development and tourism growth. The city is prone to flooding as it lies in the floodplain on the banks of river Saryu. Part of Ayodhya district shows moderate composite vulnerability to climate change, and high sectoral vulnerability to water.

With a growing populations, projected to grow to 12 lakhs by 2031 (Ayodhya Development Authority, 2021), a roadmap for assessing critical sectors and strengthening climate action at the city level is needed. By developing and implementing such a plan, Ayodhya can safeguard its invaluable cultural landmarks, enhance the resilience of its urban infrastructure, and ensure sustainable development for its diverse and growing population. The Ayodhya City Climate Action Plan covers the entire planning area of the Ayodhya city as defined in the Ayodhya Master Plan 2031.

Planning Area Profile

LOCATION

26° 48' 0" N
Longitude

82° 12' 0" E
Latitude

COMPOSITION[2]

133 sq km
Total
Planning Area

WATER RESOURCES

Saryu River

~225 ha
Wetlands

59+
Water Tanks (kunds)

Temperate Monsoon Climate

CLIMATE PROFILE*

34°C to 39°C
Seasonal Mean Maximum Temperatures

8°C to 11°C
Seasonal Mean Minimum Temperatures

872 mm
Average Total Rainfall

*Mean temperature and precipitation values are based on observed climate variability analysed for Ayodhya district for the years 1950-2020

Population for Ayodhya Development Authority Planning Area (ADA), Ayodhya Master Plan 2031

DEMOGRAPHY

Ayodhya Planning Area, 2011

2,21,118
Population (Urban ADA)

1,67,216
Population (Rural ADA)

3,88,334
Total Population

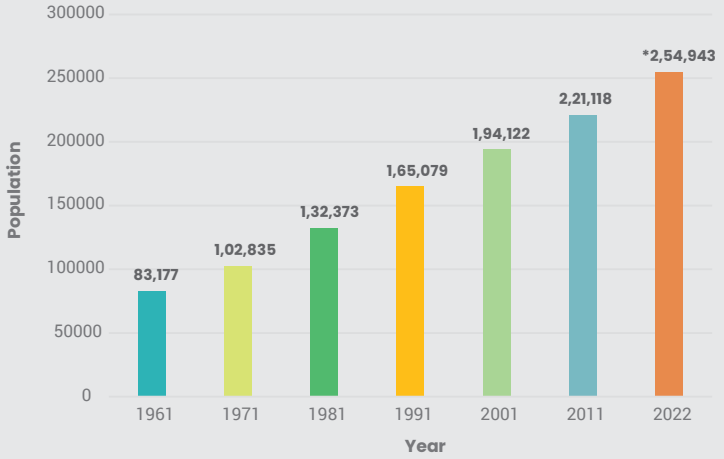


Figure 1 - Decadal population growth, urban sprawl growth trends[3]

2. Of 133 sq. km, 77.8 sq. km. of area comes under Ayodhya Nagar Nigam
3. *Population of the year 2022 is a projected value as per Ayodhya Master Plan 2031

Socio-economic

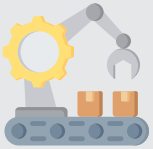
KEY MANUFACTURING INDUSTRIES

Sugar

Pulp and Paper

Bottling

Food Processing
(Jaggery Processing, Oil Mills, Flour Mills)



TOURISM

2 crore+
Tourists visited the city in 2022

Ayodhya has historically been an iconic tourist destination. With the opening of the Ram Mandir, and improved connectivity provided by the Ayodhya Airport, tourism has increased significantly with numerous hotels and lodges in the pipeline.

CONTRIBUTION TO STATE GDP

0.9%

FY 2021-22
(Ayodhya district)

Agriculture and Livestock

AGRICULTURAL LAND

9,324.30 ha

MAIN SOURCE OF IRRIGATION

Tubewells
Pump Canals

MAJOR CROPS CULTIVATED

Paddy	**Sugarcane**
Wheat	**Maize**
Mustard	**Mango**
Arhar	**Amla**
Potato	**Jaggery**
Lentil	**Vegetables**

LIVESTOCK

76,996 Total livestock population of the Ayodhya Planning Area

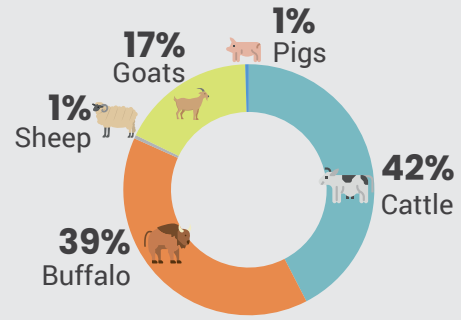


Figure 2 - Share of total livestock population, Ayodhya Planning Area, 2019[4]

4. Animal Husbandry Department, Ayodhya, 2019

Land Use and Land Cover

TOTAL AREA

Ayodhya Planning Area

133 sq km

PUBLIC UTILITY

48 Public Parks

The overall percentage of the public utility and recreational area remains low

LAND-USE PATTERN

Category-wise land use pattern for Ayodhya city in the year 2020

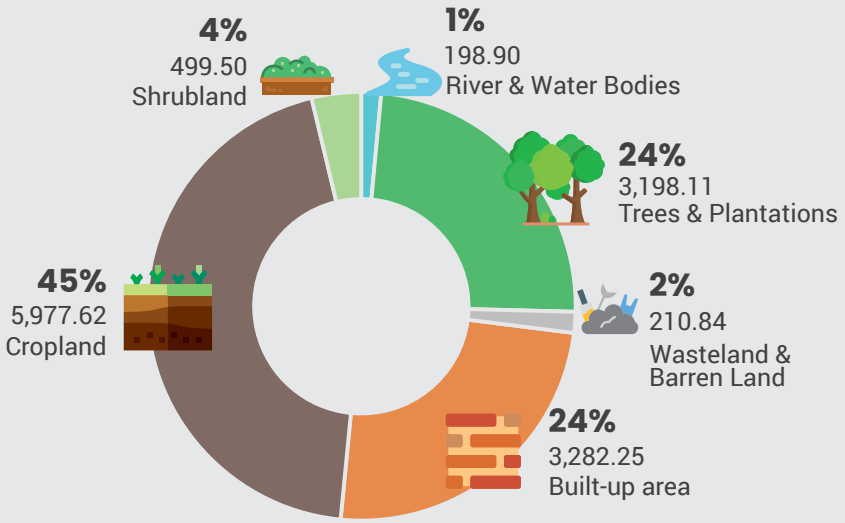


Figure 3 - Category-wise land use (ha), Ayodhya Planning Area, Ayodhya Master Plan 2031

LAND-USE MAP

Land-use map developed using satellite data[5]

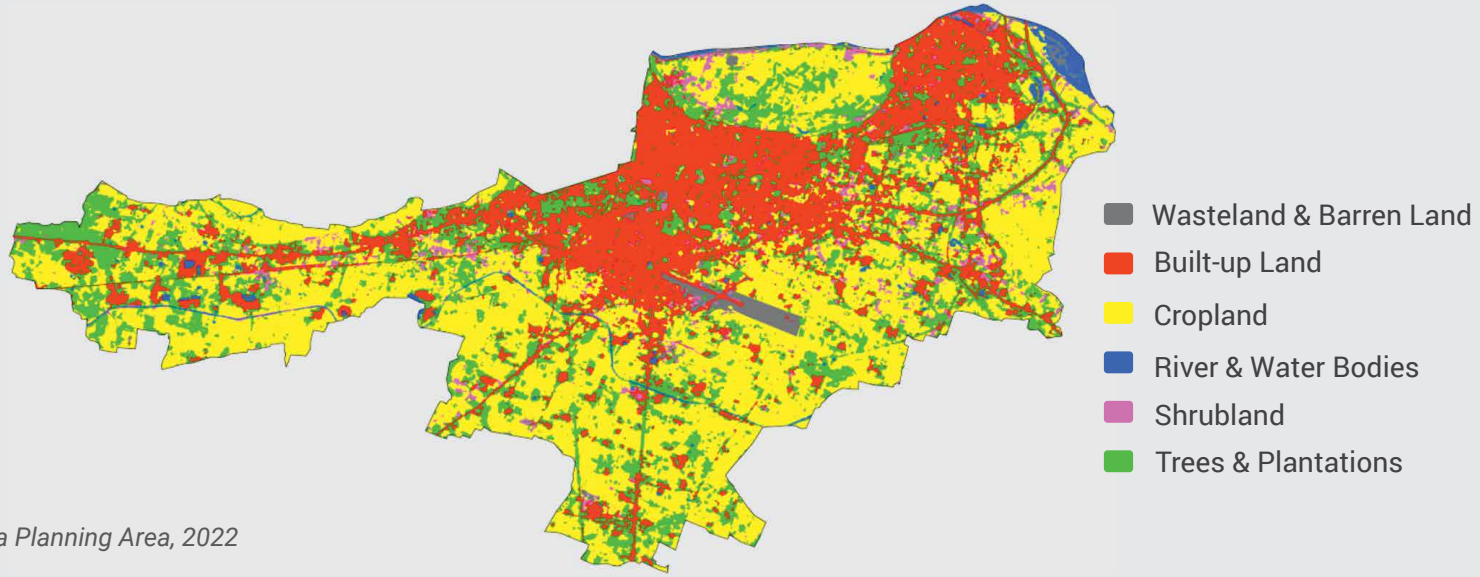


Figure 4: Land use map, Ayodhya Planning Area, 2022

5. Land-use map for Ayodhya Planning area developed using Sentinel, ESA (Category-wise details are provided in Annexure 1)

Power and Energy

ENERGY DEMAND

165 MW[6]

~280 million units per year

ELECTRICITY CONSUMPTION

280 GWh

FY 2020-21

ELECTRICITY CONNECTIONS

62,354 Total

9,860 Commercial

51,844 Residential

ELECTRICITY SUPPLY

Madhyanchal Vidyut Vitran Nigam Ltd.[7]

Two major substations

Darshan Nagar Station | 132 KV

Sohawal Station | 220 KV

RENEWABLE ENERGY GENERATION

There have been various RE generation initiatives in Ayodhya city which have majorly been a part of the Ayodhya Solar City Programme.

~6.3 MW Total Rooftop Solar PV capacity installed

3.3 MW Government Buildings

1.411 MW Residential Buildings

1.617 MW Commercial & Institutional Buildings

250 kW Solarization of Ayodhya airport

50 kW Off-grid solar plant at the Gaushala

40 MW Operational solar plant

2,710 Smart solar street lights

150 Solar high-mast lights

40 Solar trees

2 Solar-powered boats

10 Solar water kiosks

6 MT Solar-powered cold storage facility

INDUSTRIAL RENEWABLE ENERGY 28.5 MW[8]

Solar City Programme Ayodhya

Ayodhya has been announced as the Model Solar City in Uttar Pradesh. With the announcement of the Solar City Ayodhya Programme, certain short term and long-term targets have been set up for the city.

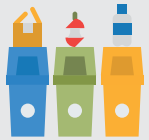
Initiatives under Phase I of the project include:

(i) **Institutional/Commercial Rooftop Solar (about 5 MWp)** provided with net metering facility shall be extended to these types of buildings apart from residential to attract the implementation. (ii) **Solar Street Lighting along Parikrama Road** situated in the temple part of the city **(1 MWp)**. The overall target of the programme is to have an installed rooftop solar capacity of **90 MW by 2027***.

6. https://www.un.org/sites/un2.un.org/files/2021/12/ayodhya_ada_energy_compact_21092021.docx.pdf
7. http://mvvnl.in/post/en-about-mvvnl?cd=MQA0AA%3d%3d
8. 20 MW bagasse-based power plant (KM Sugar Mills Ltd., Ayodhya); 8.5 MW biomass-based power plant (Yash Pakka Ltd., Ayodhya). Source: https://iced.niti.gov.in/energy/electricity/generation/power-plant-details

Waste Management and Sanitation

WASTE GENERATION



~135 tonnes[9]
Daily Solid Waste Generation

54.2% Wet Waste

34.5% Dry Waste

2.8% Domestic Hazardous Waste

2.6% Sanitary Waste

5.9% Other Waste

15.14 TPD (Tonnes per day)
of the total Municipal Solid Waste is C&D waste[10]

Only **25%** of the total collected municipal waste is segregated at source.

SOLID WASTE MANAGEMENT

100%
door to door waste collection coverage in all 60 wards[11]

5 TPD capacity Materials Recovery Facility (MRF)
operational at Kashiram Colony to manage a portion of the solid waste collected

5 MRFs of 5 TPD each
are under construction[12]

6 legacy waste dumping sites within 500 meters of the Saryu River

~2.5 lakh tonnes[13]
Estimated quantity of the existing legacy waste dumping site

WASTEWATER MANAGEMENT

~24.64 MLD Sewage
7.84 MLD Industrial Effluent
Discharged into the Saryu River through various drains in the city

15 Sewage drains that flow into the Saryu River directly[14,15,16]

18 MLD[17]
Total installed STP capacity

33 MLD
Combined capacity of STPs under construction

32 KLD
Operational faecal sludge treatment plant

93% Households have individual toilet facilities

7% Households using public toilets

Ayodhya is open defecation free *(ADA 2021)*

9. As per information received from Nagar Nigam Ayodhya
10. Draft City Solid Waste Action Plan (CSWAP)
11. Inputs from Stakeholder consultation
12. Refer to Baseline Scenario Map, Ayodhya City for details on locations of MRF centers.
13. Draft City Solid Waste Action Plan (CSWAP)
14. http://www.uppcb.com/pdf/RIVER-SARYU.pdf
15. The Central Pollution Control Board (CPCB) report of 2020 shows that the river has faecal coliform in the range of 1,100 to 2,900 Most Probable Number, which is higher than the standard quantity of 2500 MPN/100 ml (https://cpcb.nic.in/wqm/Restoration-of-Polluted-River-Stretches-Concept-Plan.pdf)
16. A project to intercept these drains and divert them to STP plants is operational under National River Conservation Plan (NRCP). Sewage discharge from these drains will be treated at 33 MLD STP site at Jamthara (https://jjm.up.gov.in/NamamiGange/Under_Construction_NamamiGange_STPs_Status. Refer to Vision for Climate Smart Ayodhya map for details on location of STP)
17. Currently 18 MLD sewage treatment plant (STP) in Ramghat Chauraha and another 6 MLD STP are operational. Additionally, a 33 MLD STP is under construction at Jamthara

Mobility

PUBLIC TRANSPORT

1 Airport

2 Railway Stations

Intra-city public transport options are limited

REGISTERED VEHICLES

6,59,137 Registered vehicles (as of September 2024)

5,35,493 Two-wheelers

0.096% CAGR, 2020 to 2023

Petrol is the primary fuel type category followed by diesel

ELECTRIC VEHICLES

Year-on-year increase in number of EVs between 2021-2023[18]

0.596% CAGR, 2019 to 2023

0.73% Share of 2-wheeler EVs of total vehicle registrations in 2023

Water[19]

Primary SOURCE

For the Municipal Area (77.8 sq.km)

31.82 MLD (Million Liters Per Day)
Groundwater, Primary Source

8.01 MLD
Handpumps, Secondary Source

CONSUMPTION

~9,975 million litres
Current annual water consumption demand met through piped water supply

27.33 MLD[20]
Domestic sector consumption

PROJECTED DEMAND

47 MLD[21]
Additional water demand during peak tourist season

~161 MLD
Demand of potable water, projected to rise by 2031

Biodiversity

WATER BODIES

Area of Water Bodies
~200 ha

Dolphin, Gharial & Fresh-water Turtle[22]

Home to rare species

AQUATIC BIRDS

Observed near Saryu River

43
Total Species

25
Resident Species

18
Migratory Species

TREES & PLANTATION COVER

~3,200 ha of the Planning Area *(See Figure 3)*

~241,700 saplings were planted between 2021 and 2023 as part of various plantation drives

As part of eco-restoration initiatives in the city,
An eco-resort near Samda Lake and a bird sanctuary are being planned[23]

18. As part of the Solar City Ayodhya Programme, there are plans to introduce 193 AC EV buses with charging infrastructure
19. There also exist constructed water storage tanks within the city, traditionally called 'kunds'. While there were several such water bodies historically, a number of them have been lost to encroachment and land use change. Approximately 59 such 'kunds' are currently present in the city
20. As per information provided by Jal Nigam Department
21. Peak tourism season water demand has been (months of August to December, 2023) estimated for average per day tourism inflow of ~3,53,000 persons; https://uptourism.gov.in/en/post/Year-wise-Tourist-Statistics. *Participated number of tourists is expected to continue to increase
22. https://www.researchgate.net/publication/352374400_Status_and_Distribution_of_Gangetic_River_Dolphins_Platanista_gangetica_gangetica_and_other_aquatic_vertebrates_of_Saryu_Ghaghra_River_Uttar_Pradesh
23. https://invest.up.gov.in/wp-content/uploads/2023/01/Global-standard_020123.pdf

13

Historic Climate Variability

1. Key Findings

Rainfall

- The district[24] experiences considerable year-to-year rainfall fluctuations, particularly during the southwest monsoon season (June through September)[25] and specific monsoon months. There is no significant trend in seasonal rainfall during the southwest monsoon period.
- It has been noted that the variability in the number of rainy days[26] is more pronounced in July and August, while there is a significant decreasing trend in the total number of rainy days in the southwest monsoon season.
- The southwest monsoon rainfall is projected to increase by 9% to 23% under Representative Concentration Pathway (RCP)4.5 and 14% to 41% under RCP8.5 emission scenarios.
- The number of rainy days is also projected to increase during the southwest monsoon season under both emission scenarios, with more increase in July and August.
- The 1-DAY and 5-DAY precipitation events are also projected to increase under RCP4.5 and RCP8.5 scenarios compared to the historical period.

Maximum Temperature

- Maximum temperatures during the summer months (March-April-May) exhibit a declining tendency, although no significant trend is observed. From 1951 to 2020, the average percentage of warm days[27] in this region has decreased.
- The maximum temperature is projected to increase by 1.2°C to 2.6°C under RCP4.5 and 1.3°C to 5.0°C under RCP8.5 scenario.
- The percentage of warm days is projected to increase in the district by the end of the century compared to the present climate.
- There is a slight increase in heat wave duration and frequency under RCP4.5 and RCP8.5 scenarios, though not statistically significant compared to the present climate.

Minimum Temperature

- Minimum temperatures (December-January-February) and the mean percentage of cold days[28] have not shown any increased/decreased trend.
- In the winter season, the minimum temperatures also show a projected increase (1.0°C to 2.2°C under RCP4.5 and 1.2°C to 2.6°C under RCP8.5 scenarios) with a decrease in percentage of cold days under changing climate conditions.

24. This assessment was done for the district as a whole due to lack of availability of granular data. Climate effects may vary for Ayodhya Planning area due to factors such as urban heat island effect, higher population density, etc.,
25. From a climatological perspective, July and August are identified as the primary months for rainfall, with July being the month that receives the maximum precipitation.
26. A rainy day, according to the India Meteorological Department, is defined as any day on which rainfall is more than 2.5 mm.
27. Warm days are Percentage of days when maximum temperature is greater than the 90th percentile
28. Percentage of days when maximum temperature is less than the 10th percentile

2. Observed Climate Variability[29]

Ayodhya district exhibits a varied climate influenced by its geographical characteristics and seasonal changes. Situated in the subtropical climate zone, it features distinct seasons and varying weather patterns. The summer months are marked by hot and dry conditions, with temperatures often surpassing 40°C, creating a need for precautions against heat-related health risks. Generally, the monsoon over Ayodhya starts in July and lasts until September, brings essential relief through moderate to heavy rainfall, which replenishes water resources and supports agricultural activities. This season also contributes to the region's lush greenery, enhancing its natural beauty. The monsoon season is crucial for farmers, as it significantly impacts crop yields and overall agricultural productivity. December to February, its winter in Ayodhya, bringing cooler temperatures and occasional foggy mornings. While daytime temperatures are generally comfortable, ranging from 8-11°C, nights can be chilly, requiring warmer clothing. In conclusion, Ayodhya's climate offers a range of experiences throughout the year.

Precipitation Variability

Maximum rainfall occurrs during the southwest monsoon season, which spans from June to September, with a mean of 872 mm rainfall from 1951 to 2020. There is, however, significant variability in the distribution of rainfall across different months and seasons. June to September are identified as the primary rainy months for the district, with July being the month that receives the maximum precipitation, averaging 304 mm, followed by August, which typically sees around 259 mm of rainfall. Figure 5 illustrates the year-to-year variability in rainfall during the southwest monsoon months and the overall season from 1951 to 2020 in Ayodhya district. Notably, there is no significant trend in rainfall during the southwest monsoon months, except for August, which exhibits a decreasing trend. The number of rainy days, defined as days with 2.5 mm or more of rainfall, ranges from 0 to 15 per month, with an average of over 40 rainy days during the southwest monsoon season. It has been noted that the variability in the number of rainy days is more pronounced in July and August. Additionally, there is a significant decreasing trend in the number of rainy days during the southwest monsoon season from 1951 to 2020, as shown in Figure 6.

Temperature Variability

The mean maximum summer temperatures (March-April-May) vary between 34°C and 39°C, with May identified as the hottest month in the region. There is no significant trend in maximum temperatures during these months, except for May, which depicts a decreasing trend (Figure 7). Additionally, the average percentage of warm days throughout the season demonstrates a significant decreasing trend (Figure 8) in the district. In winter (December-January-February), temperatures range from 8°C to 11°C, with January being the coldest month in the district. The year-to-year fluctuations in minimum temperatures (Figure 9) reveal a significant rise in the mean minimum temperature from 1951 to 2020. Furthermore, the average percentage of cold days has diminished in recent decades (Figure 10).

29. Refer to Annexure 2 for details on Methodology

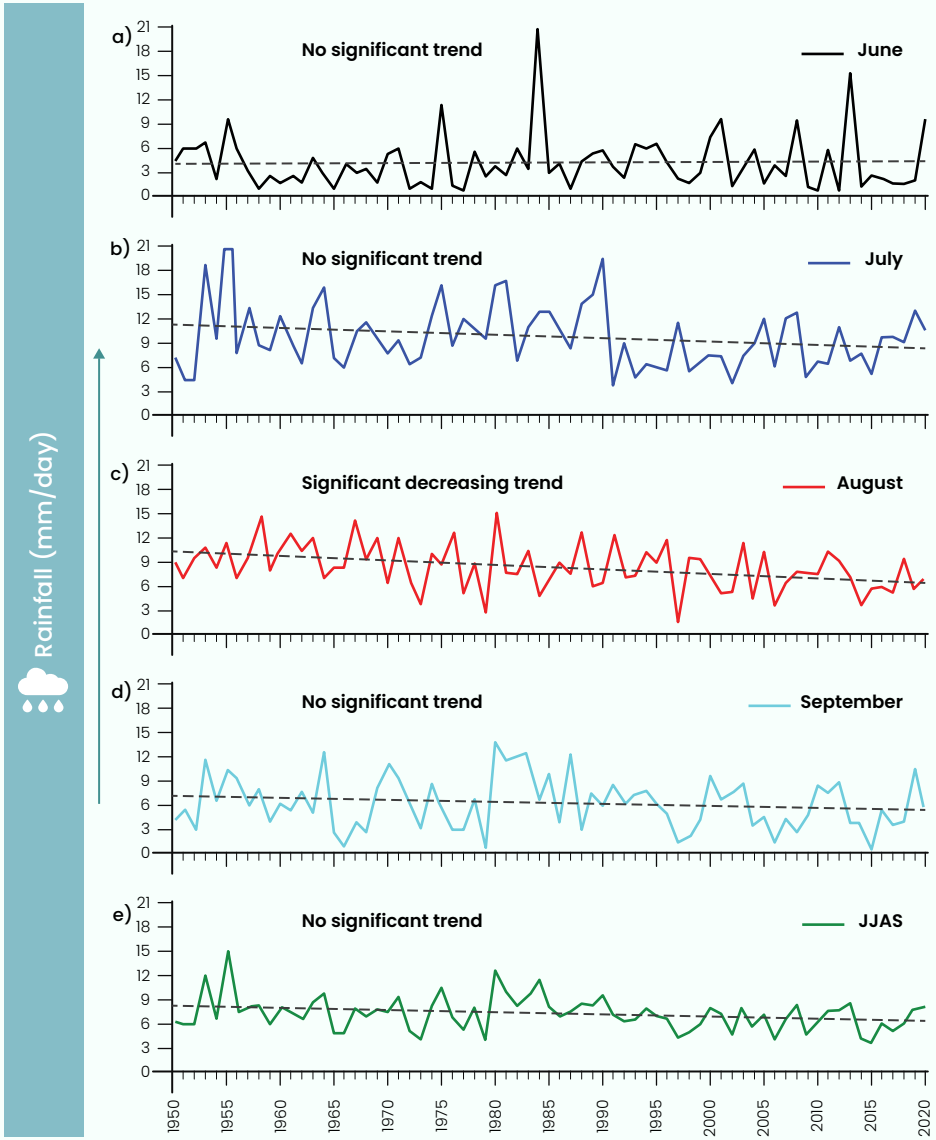


Figure 5: Inter annual variability of southwest monsoon rainfall (mm/day) over Ayodhya for 1951-2020

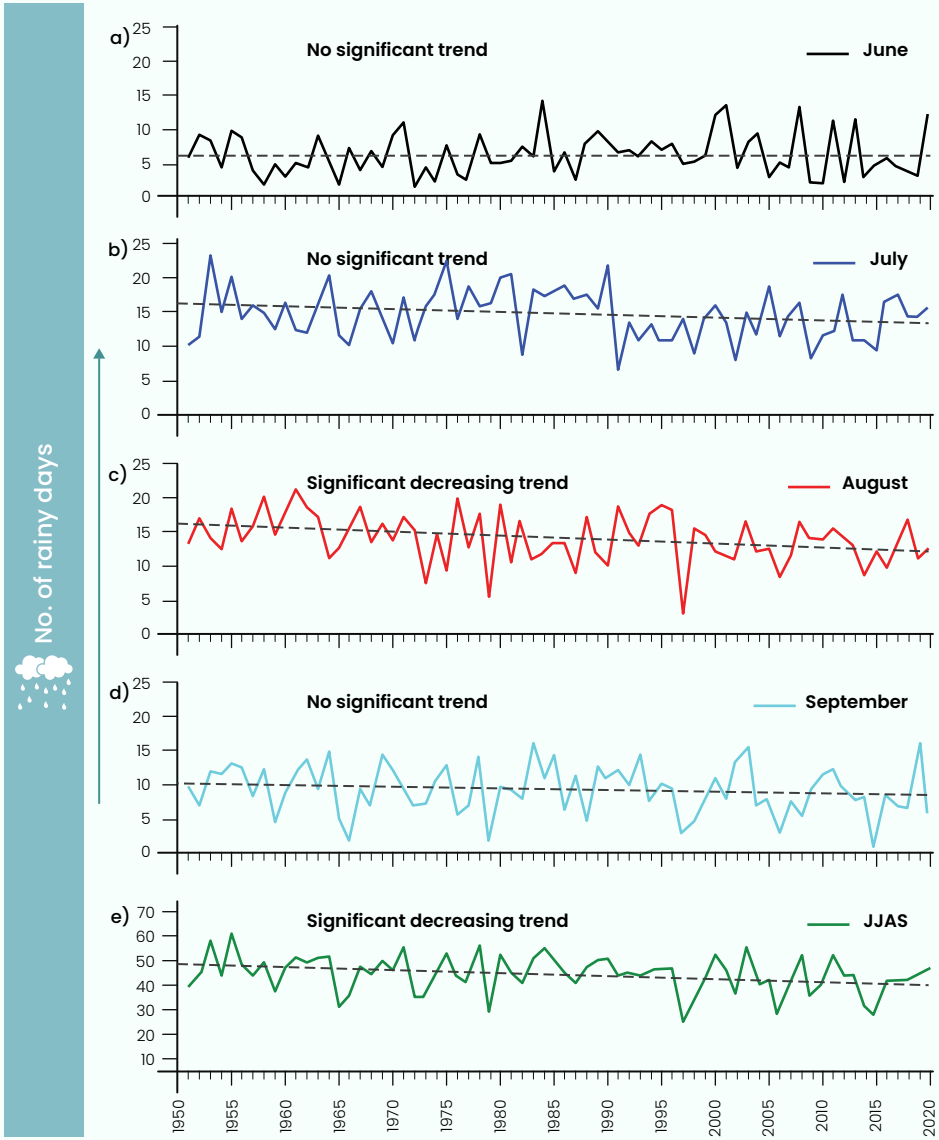


Figure 6: Inter annual variability of number of rainy days during southwest monsoon over Ayodhya for 1951-2020

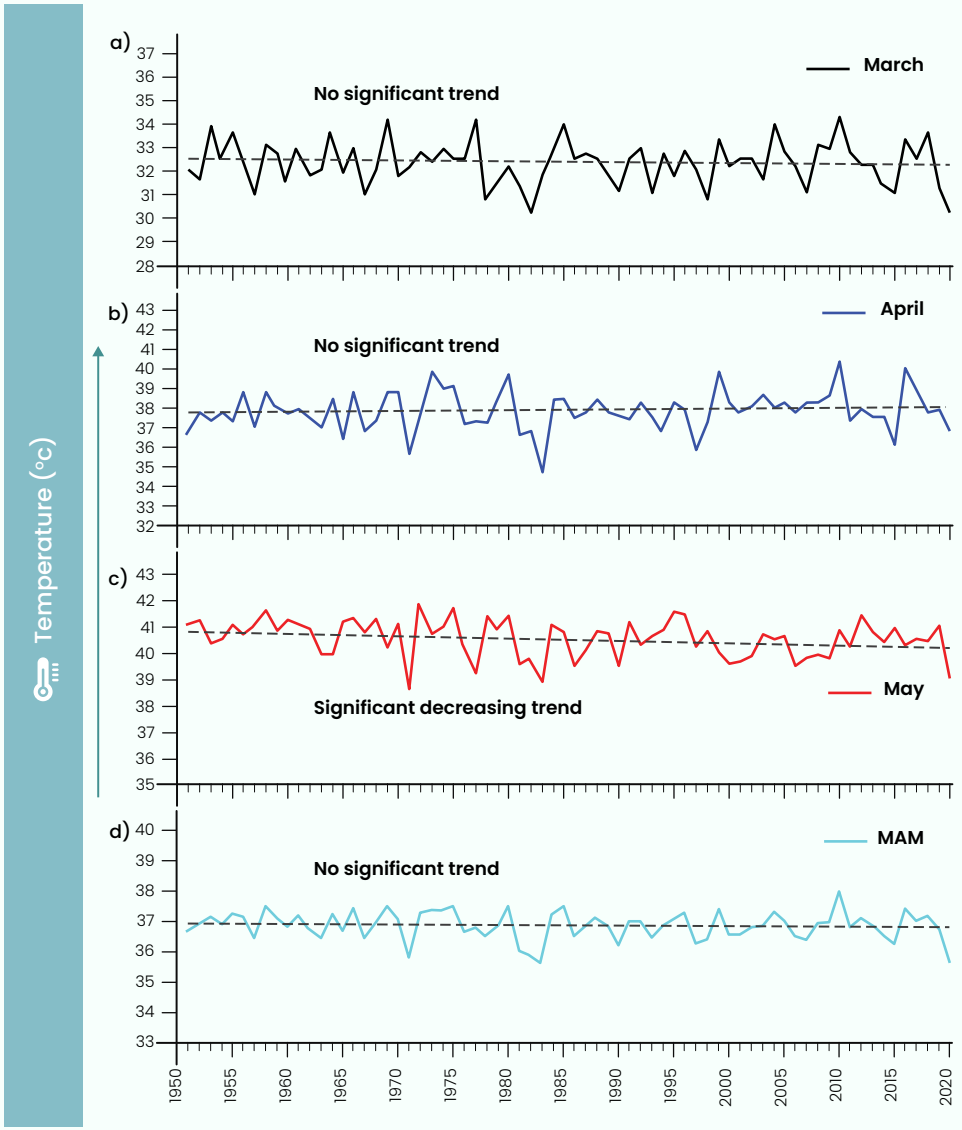


Figure 7: Inter annual variability of maximum temperature (°C) over Ayodhya for 1951-2020

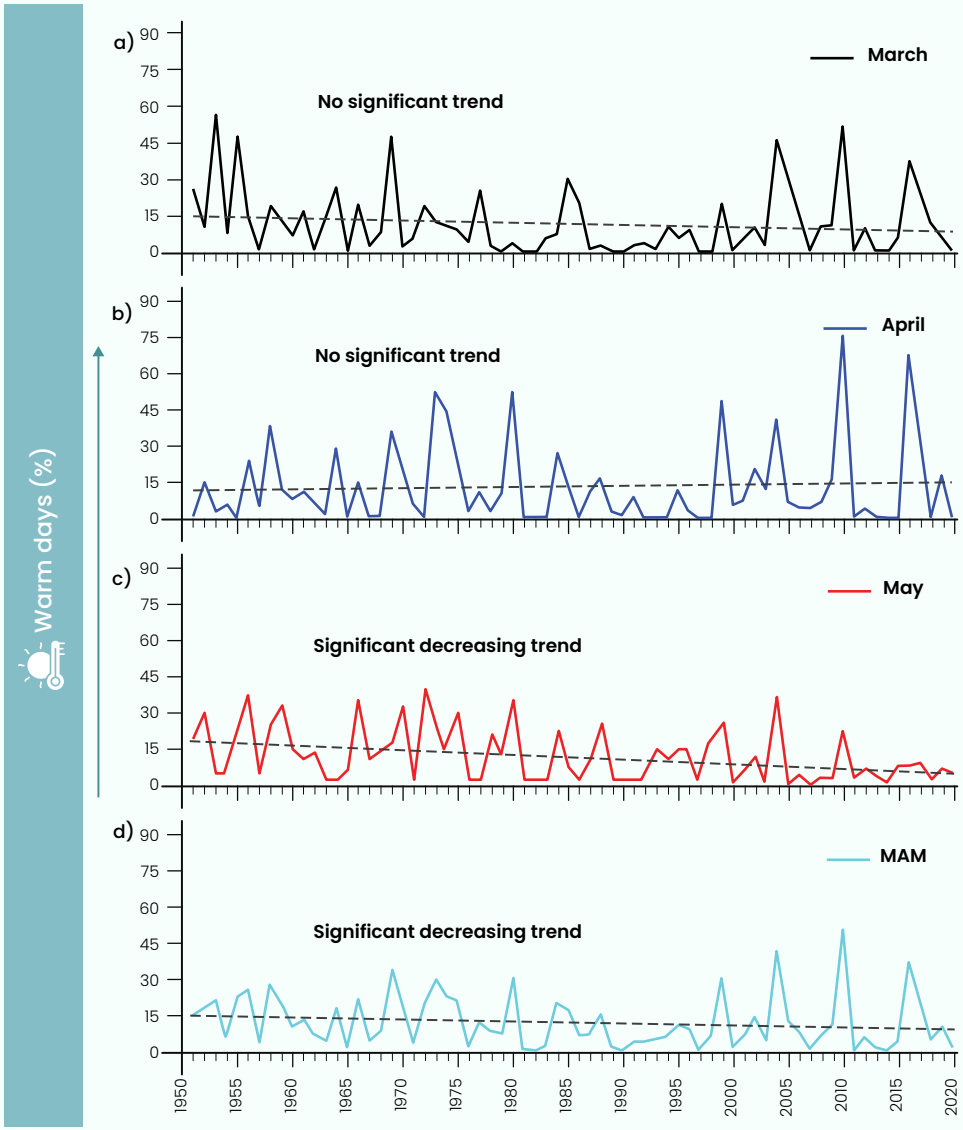


Figure 8: Inter annual variability of warm days (%) over Ayodhya for 1951-2020

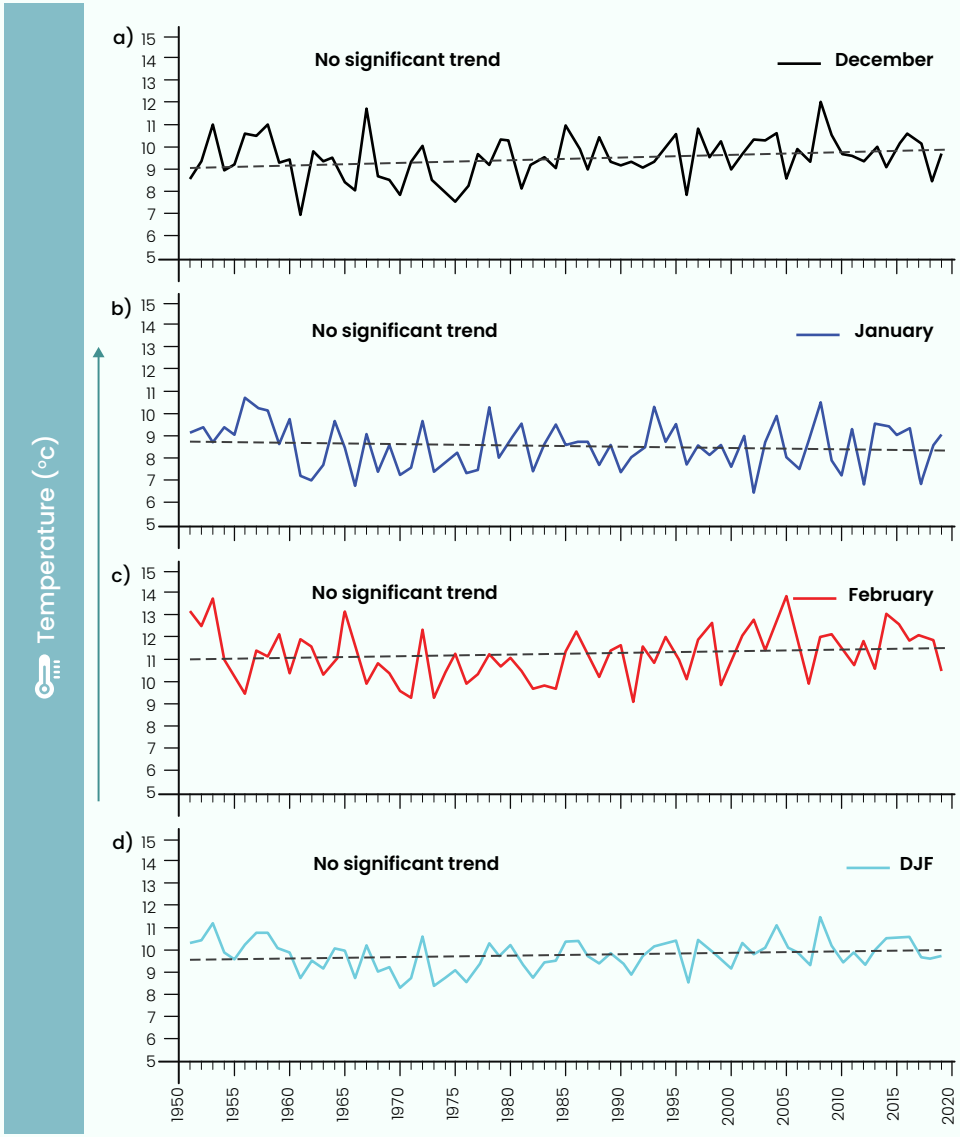


Figure 9: Inter annual variability of minimum temperature (°C) over Ayodhya for 1951-2020

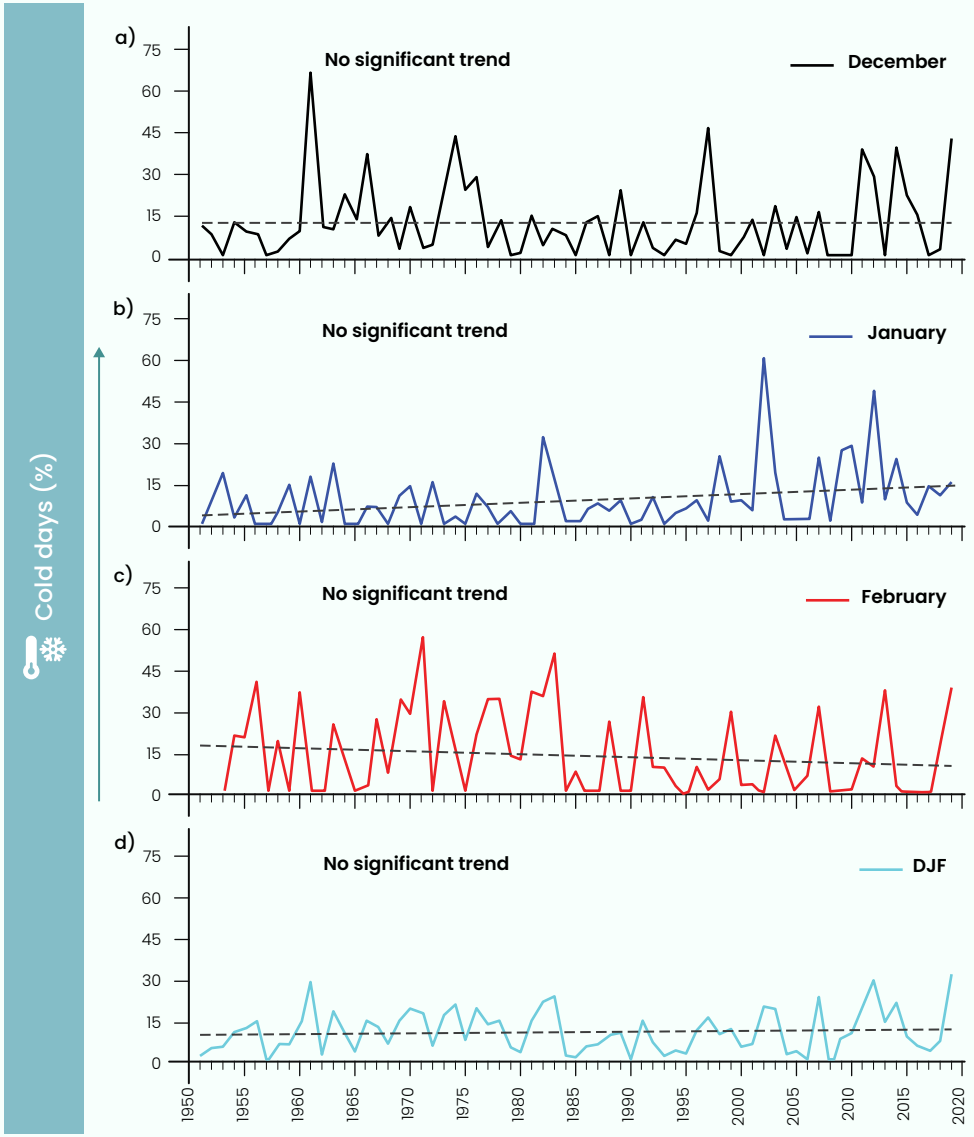


Figure 10: Inter annual variability of cold days (%) over Ayodhya for 1951-2020

3. Future Climate Projections for Ayodhya

To assess future climate projections for the district, this analysis utilises the dataset from NASA Earth Exchange Global Daily Downscaled Projections (NEX-GDDP), which is a bias-corrected, high-resolution, statistically downscaled dataset derived from 20 General Circulation Models (GCMs) under the CMIP5 (Climate Model Intercomparison Project) framework. The study focuses on two greenhouse gas emission scenarios: RCP4.5 and RCP8.5. Precipitation and temperature data for Ayodhya from 1986 to 2005 have been simulated using the Multi-Model Mean (MMM). Projections indicate that Ayodhya district may see an increase in rainfall during the monsoon months across various time frames (2021-2040, 2041-2060, 2061-2080, and 2081-2100) under both medium (RCP4.5) and high (RCP8.5) emission scenarios.

The models indicate a consistent mild wet bias for the months of June to September, as well as throughout the southwest monsoon season, relative to the baseline period of 1986 to 2005 (Table 1). Additionally, there is an overestimation of rainy days on both monthly and seasonal scales (Table 2). During the southwest monsoon, precipitation is projected to increase by 8% to 23% under the RCP4.5 scenario and by 14% to 41% under the RCP8.5 scenario (Table 1). Furthermore, the number of rainy days is anticipated to increase during the monsoon season for both emission scenarios, with a more significant rise expected in July and August (refer Table 2).

This report examines the anticipated changes in maximum and minimum temperatures during the summer (March to May) and winter (December to February) seasons. The projections for different time periods indicate that maximum temperatures may rise by 1.2°C to 2.6°C under the RCP4.5 scenario and by 1.3°C to 5.0°C under the RCP8.5 scenario across the district (Table 3). By the end of the century, the proportion of warm days in the district is expected to increase compared to present climate conditions (Table 4). In the winter months, minimum temperatures are also projected to rise, with the magnitude ranging from 1.0°C to 2.2°C under RCP4.5 and from 1.2°C to 2.6°C under RCP8.5 (Table 5). Additionally, there is an expected decline in the percentage of cold days across all time periods due to changing climate conditions (Table 6).

Table 1: Observed (1986-2005), simulated (1986-2005), and projected mean monthly and seasonal southwest monsoon rainfall (mm) for Ayodhya district

Rainfall (mm)	June	July	August	September	June to September
Obs	129.0	270.6	279.9	179.5	859.0
Hist	113.0	296.1	294.2	185.3	888.6
RCP4.5					
2030s	126.6	303.8	321.9	213.6	965.9
2050s	119.5	326.8	332.3	231.0	1009.6
2070s	135.09	330.9	320.1	257.4	1043.5
2090s	139.8	351.1	361.5	238.5	1090.9
RCP8.5					
2030s	119.8	339.8	323.3	233.2	1016.1
2050s	142.9	341.5	363.6	242.6	1090.6
2070s	143.5	364.2	384.3	259.8	1151.8
2090s	139.8	421.8	410.0	282.1	1253.7

Table 2: Observed (1986-2005), simulated (1986-2005), and projected mean number of rainy days (rainfall > 2.5 mm) during southwest monsoon months and season for Ayodhya district

Rainfall (mm)	June	July	August	September	June to September
Obs	7	14	14	10	45
Hist	7	17	17	11	52
RCP4.5					
2030s	7	16	17	12	52
2050s	7	17	17	12	53
2070s	8	16	17	13	54
2090s	8	17	18	13	56
RCP8.5					
2030s	7	16	16	12	51
2050s	7	16	17	12	52
2070s	7	16	17	13	53
2090s	7	16	18	13	54

Table 3: Simulated and projected monthly and seasonal maximum temperature (°C) for Ayodhya district

Temp. max (°C)	March	April	May	March to May
Obs	32.3	38.1	39.6	36.6
Hist	32.4	37.8	40.3	36.8
RCP4.5				
2030s	33.6	39.0	41.5	38.0
2050s	34.5	39.7	41.9	38.7
2070s	34.9	40.4	42.5	39.2
2090s	35.1	40.4	42.7	39.4
RCP8.5				
2030s	33.7	39.1	41.5	38.1
2050s	34.9	40.3	42.6	39.3
2070s	36.3	41.5	43.7	40.5
2090s	37.7	42.8	44.9	41.8

Table 4: Simulated and projected monthly and seasonal warm days (%) relative to baseline for Ayodhya district

Warm days (%)	March	April	May	March to May
Obs	9	10	10	10
Hist	9	10	10	10
RCP4.5				
2030s	25	29	36	30
2050s	36	42	47	42
2070s	43	54	62	53
2090s	48	54	64	55
RCP8.5				
2030s	27	32	41	33
2050s	45	54	64	54
2070s	67	74	83	75
2090s	79	86	91	85

Table 5: Simulated and projected monthly and seasonal minimum temperature (°C) for Ayodhya district

Temp. min (°C)	Dec	Jan	Feb	December to February
Obs	9.6	8.5	11.5	9.9
Hist	10.5	9.1	11.3	10.3
RCP4.5				
2030s	11.4	10.2	12.3	11.3
2050s	12.0	10.7	12.8	11.8
2070s	12.6	11.2	13.2	12.3
2090s	12.6	11.4	13.5	12.5
RCP8.5				
2030s	11.7	10.3	12.4	11.5
2050s	12.7	11.3	13.5	12.5
2070s	13.9	12.7	14.8	13.7
2090s	15.1	13.9	16.0	14.9

Table 6: Simulated and projected monthly and seasonal cold days (%) relative to baseline for Ayodhya district

Temp. min (°C)	Dec	Jan	Feb	December to February
Obs	10	10	9	10
Hist	10	10	9	10
RCP4.5				
2030s	5	4	5	4
2050s	3	3	2	3
2070s	2	1	2	2
2090s	2	1	1	1
RCP8.5				
2030s	4	5	4	4
2050s	2	2	2	2
2070s	1	1	1	1
2090s	1	0	0	0

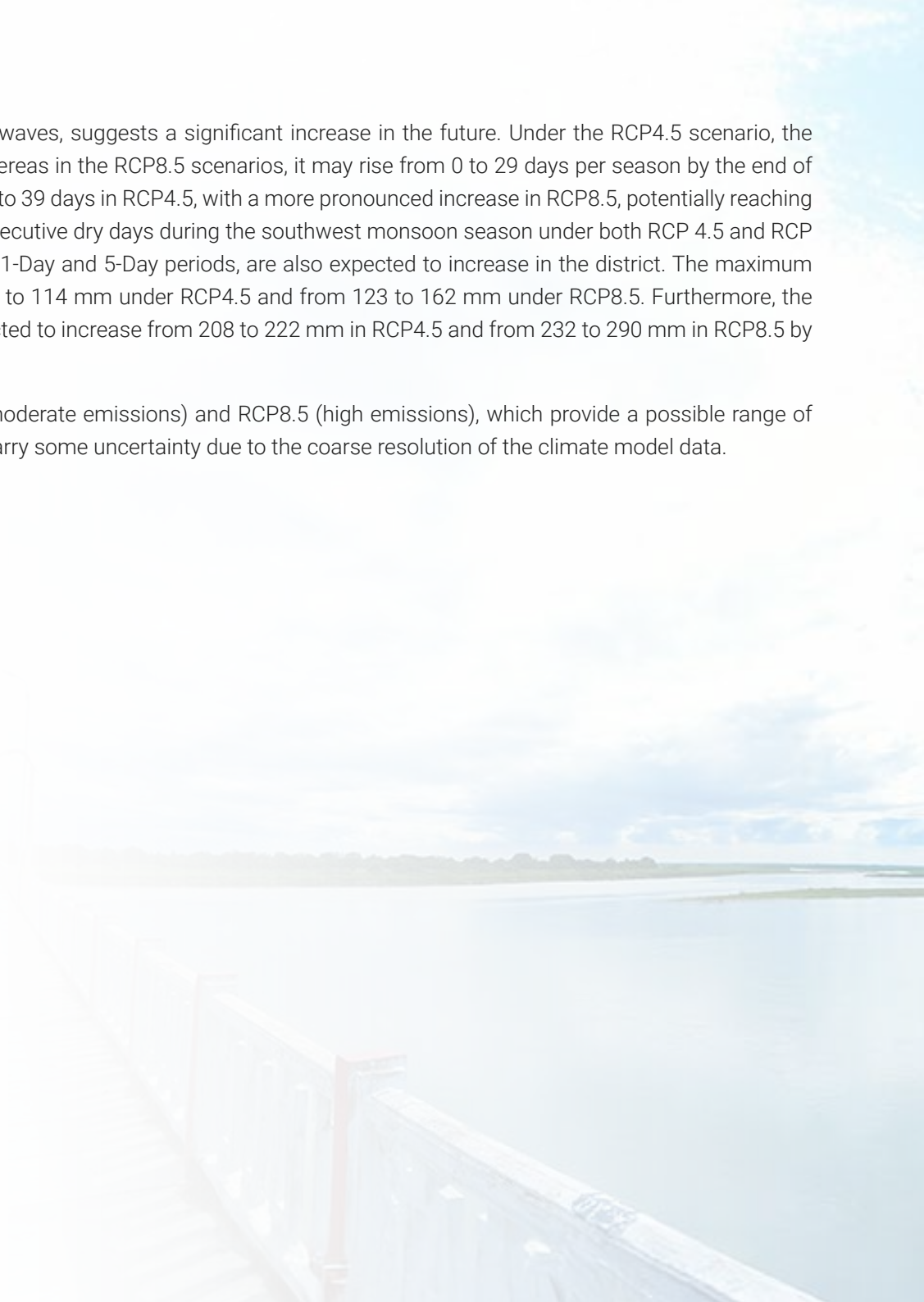
Table 7: Simulated and projected seasonal temperature and precipitation extremes relative to baseline for Ayodhya district

Indices	HWDI[30]	HWFI[31]	CDD JJAS[32]	RX1DAY JJAS[33]	RX5DAY JJAS[34]
Obs	0	3	15	93.5	167.8
Hist	0	3	16	95.0	186.0
RCP4.5					
2030s	1	17	15	105.7	208.3
2050s	2	27	15	108.1	214.1
2070s	4	37	15	109.3	215.7
2090s	6	39	15	114.3	222.5
RCP8.5					
2030s	1	19	16	123.5	232.0
2050s	5	38	15	131.0	240.1
2070s	18	59	16	146.5	259.2
2090s	29	72	15	161.9	289.9

30. HWDI: The number of heat wave periods not less than 5 days.
31. HWFI: Maximum number of consecutive days per year when the daily maximum temperature is above the 90th percentile.
32. CDD refers to maximum number of consecutive dry days per time period with daily precipitation amount of less than 1 mm.
33. RX1DAY refers to highest 1-Day precipitation amount.
34. RX5DAY refers to highest consecutive 5-Day precipitation amount.

Analysis of temperature extremes, focusing on the duration and frequency of heat waves, suggests a significant increase in the future. Under the RCP4.5 scenario, the projected change in the Heat Wave Duration Index (HWDI) is relatively minimum, whereas in the RCP8.5 scenarios, it may rise from 0 to 29 days per season by the end of the century. The Heat Wave Frequency Index (HWFI) is projected to increase from 17 to 39 days in RCP4.5, with a more pronounced increase in RCP8.5, potentially reaching 17 to 72 days by the end of the century. Additionally, there is a slight increase in consecutive dry days during the southwest monsoon season under both RCP 4.5 and RCP 8.5 scenarios. Extreme rainfall events, particularly the highest rainfall amounts over 1-Day and 5-Day periods, are also expected to increase in the district. The maximum 1-Day rainfall during the southwest monsoon season is anticipated to rise from 105 to 114 mm under RCP4.5 and from 123 to 162 mm under RCP8.5. Furthermore, the cumulative highest precipitation over 5 days during the southwest monsoon is projected to increase from 208 to 222 mm in RCP4.5 and from 232 to 290 mm in RCP8.5 by the end of the century.

This report outlines climate change projections based on two scenarios: RCP4.5 (moderate emissions) and RCP8.5 (high emissions), which provide a possible range of potential future projections. It is important to note that the findings presented may carry some uncertainty due to the coarse resolution of the climate model data.



04

Greenhouse Gas Emissions Profile of Ayodhya Planning Area


FRONTLINE

In order to prepare a robust climate action plan, a baseline greenhouse gas profile/carbon footprint of Ayodhya would help in identifying key areas for emission reduction. Hence, this section estimates greenhouse gas (GHG) emissions for Ayodhya city using the guidelines laid down by the Intergovernmental Panel on Climate Change (IPCC). Estimates have been provided for nine key categories where GHG emissions occur in the city, namely, solid waste, domestic wastewater (urban and rural), industrial wastewater, crop burning, rice cultivation, livestock, electricity consumption, and transport fuel consumption.

The estimated GHG[35] emissions of Ayodhya were due to activities in the solid waste, domestic wastewater, and industrial wastewater in the waste sector. In the agriculture sector, emissions are from rice cultivation, application of fertilisers on agricultural fields, enteric fermentation in livestock and management of animal waste and crop residue burning. In the energy sector emissions are due to electricity consumption[36], and use of fossil fuel in road transport.

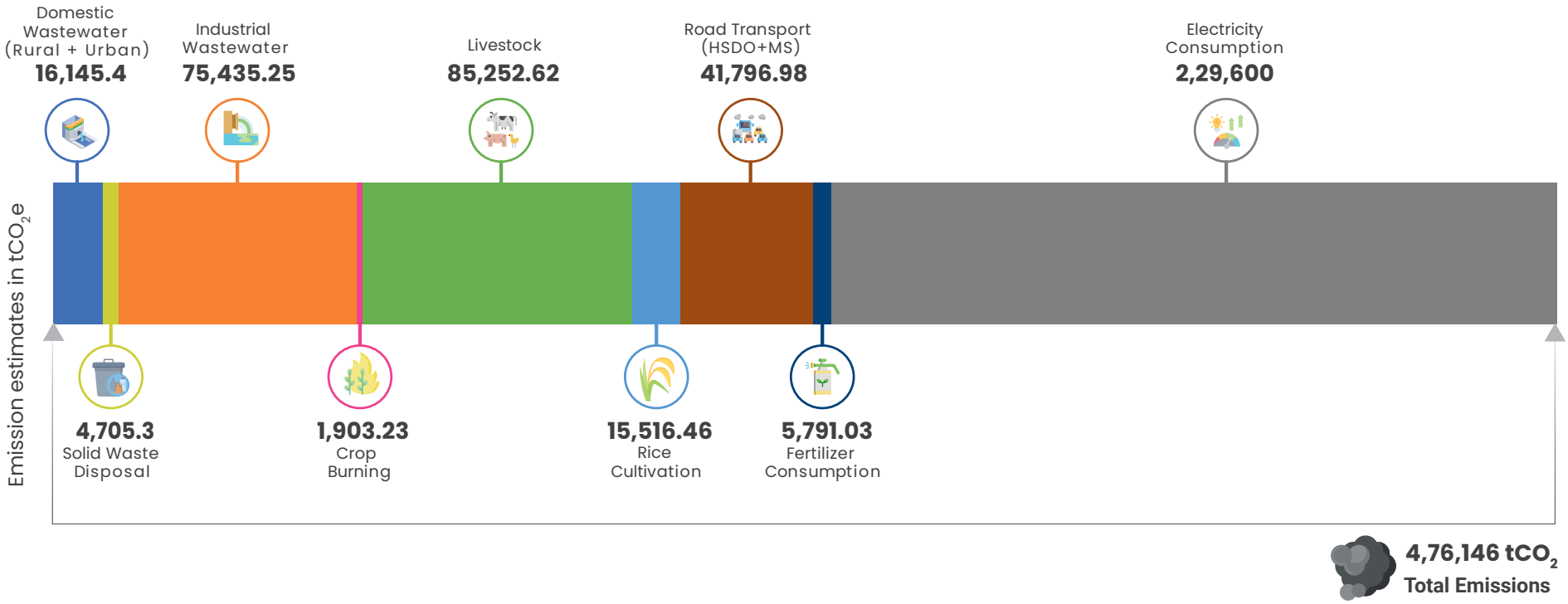


Figure 11: GHG emissions from various activities in Ayodhya in 2022

35. The activity data was sourced from government-approved datasets for all the sectors and wherever possible, country specific emission factors were used in place of default-emission factors. Additionally, certain data was also collected from concerned departments and ULBs.
36. Emissions due to electricity consumption are categorized as Scope 2 emissions, as the fuel (coal) combustion for electricity generation takes place outside the city boundary

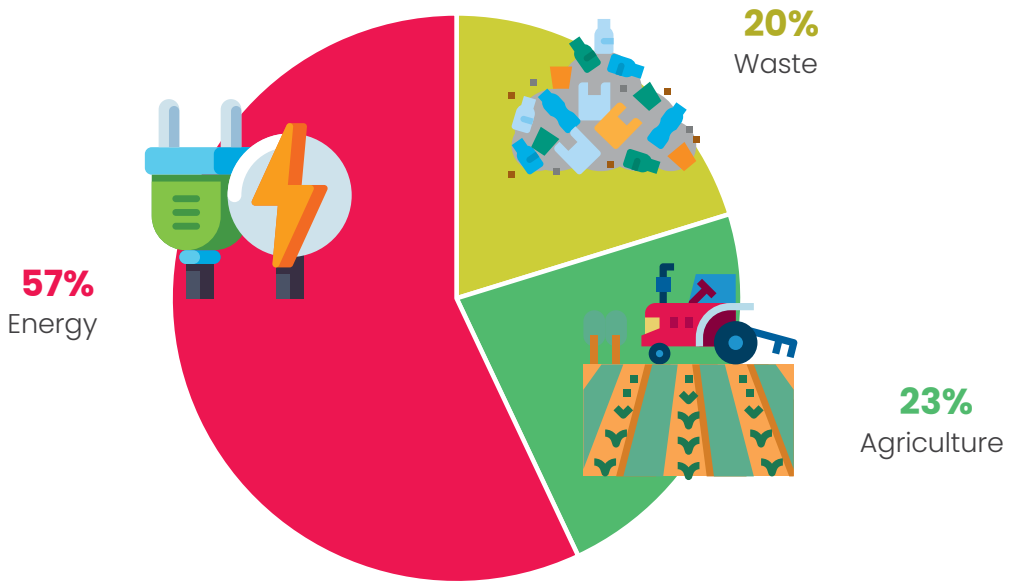


Figure 12: Share of sector in GHG emissions of Ayodhya in 2022

The energy sector accounted for 57 percent of the total emissions. Within the sector, electricity consumption was the key emitter (2,29,600 tCO_2e), followed by the transport sector (~41,797 tCO_2e). The agriculture sector accounted for 23 percent of the total emissions of Ayodhya. Within the sector, livestock was the key emitter (~85,252 tCO_2e), this was followed by rice cultivation (~15,516 tCO_2e), fertilisers emission (~ 5,791 tCO_2e) and crop residue burning (~1,903 tCO_2e). Emissions from the waste sector accounted for 20 percent of the total emissions. Within the sector, industrial wastewater was the key emitter (~75,435 tCO_2e) followed by domestic wastewater (16,145 tCO_2e) and solid waste (~4705 tCO_2e).

Mitigating GHG emissions requires targeted solutions in sectors that are the highest contributors. The proposed climate smart activities (see section on 'Recommendations for Climate Smart Activities') offer viable pathways to reducing emissions across key sectors, focusing on transitioning to renewable energy, improving energy efficiency, and adopting sustainable agriculture practices.

05

Challenges in Ayodhya from a Climate Lens

The city of Ayodhya has become increasingly tourism-focused, with projected annual tourist footfall of over 4 crore by 2031. The issues laid out in this section have been identified through secondary research and discussions with various stakeholders[37]. Additionally, a perception survey on climate change and related issues was carried out in Ayodhya city to collect the perception of citizens on key environment, climate, and urban development issues. Over 800 respondents provided inputs for the survey. These responses were mapped and analysed to identify perceptive developmental challenges and issues in the city. The survey also tried to assess if citizens were aware of climate change as a policy issue in the urban context. Key insights from the survey have also been highlighted in the section below:

Sectoral Issues Identified

1. Solid Waste

- Lack of waste collection, segregation, and effective waste treatment system in the city leading to pollution in urban and peri-urban areas.
- Transportation of waste to disposal sites in uncovered vehicle compartments, leading to unpleasant odours. Spillage of waste due to improper loading.
- Improper disposal of religious waste around the temple complex.

2. Limited Wastewater Management

- The city currently has one functional Sewage Treatment Plant (STP) with a capacity of 18 million litres per day (MLD).
- Absence of proper wastewater management systems leading to untreated wastewater from open channels being directly discharged into the Saryu river and contaminates the drinking water sources.
- Insufficient storm water drains.

37. A series of meetings was held with department officials during the development of this plan, including ULBs, and district level departments. After an initial multi-stakeholder meeting with the

Box Item 1: Perception Survey, Priority Sectors for City's Development by Residents

Waste and Sanitation

This indicates that waste management and sanitation issues are currently considered the most critical and urgent focus area. High priority in waste and sanitation could suggest that there might be pressing environmental or public health concerns related to waste disposal, recycling, pollution, or access to proper sanitation facilities.

Enhancing Cooling Measures for the City

Urban cooling was understood to be an important consideration for the city's development. The city of Ayodhya falls in the Eastern plain agro-climatic zone, which features hot and humid conditions during the summer months. Rapid urbanisation and infrastructure development in the city further creates a challenge.

Rejuvenation of Natural Water Bodies

River Saryu, the main river flowing through the city holds sentimental as well as cultural value for the residents due to its historical significance. Additionally, the region, which once had numerous ponds and wetlands, has seen a decrease in their area due to unplanned expansion of settlements.

The responses indicate that residents ascribe importance to maintaining a balance between preserving natural capital and enhancing civic amenities and green infrastructure. A comprehensive climate action strategy for the city will ensure that policies and planning are geared towards addressing both simultaneously.

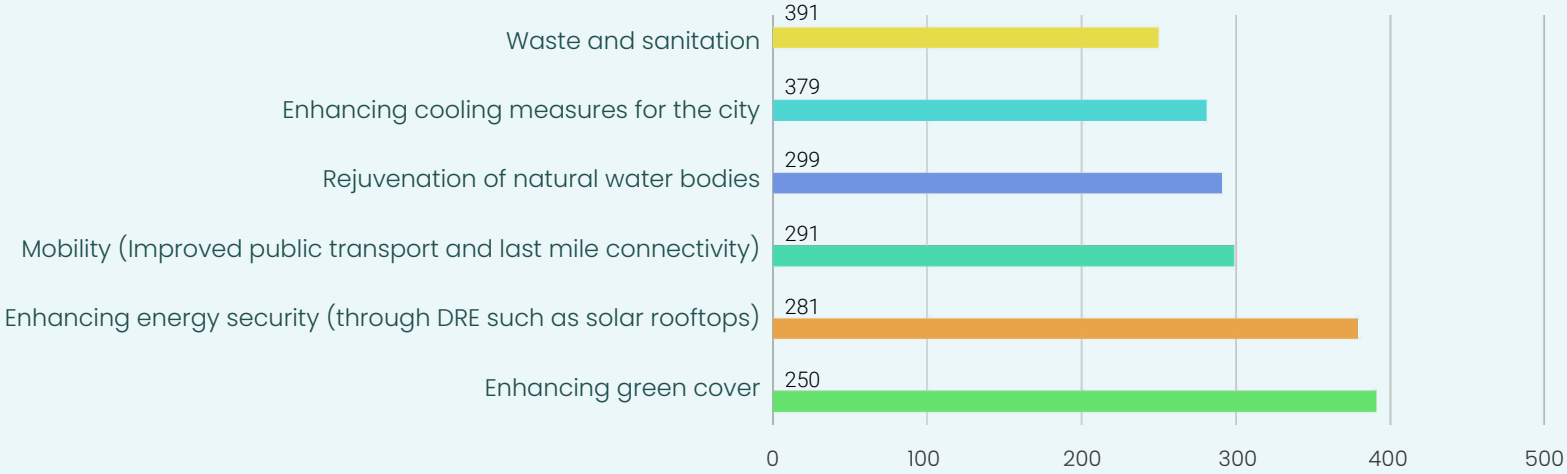


Figure 13: Developmental priorities ranked as highest priority by respondents (n=897)

Note: The priority values alone does not provide the full context or reasoning behind these responses. The decision to prioritise one category over another may involve various factors and parameters including environmental concerns, public health, economic considerations, and community needs.

3. Water

- Water availability is a key concern in the city. As per one study, in 2021, there was a shortage of 10 million litres per day (MLD) in the water supply of Ayodhya city[38,39].
- There is a lack of centrally controlled distribution of water supply, with most areas dependent on untreated groundwater (ADA 2021)[40].

4. Electricity

- Access to reliable electricity supply was reported to be another key issue faced by the residents of Ayodhya. The power supply in the area is irregular due to the presence of outdated or overloaded transformers.
- Furthermore, the power shortage is exacerbated during high load seasons.

5. Transport

- Traffic congestion is a problem during peak hours as the traffic rules are not followed strictly. The absence of cycling and walking paths also impedes movement of Non-motarised transport (NMT) traffic, and is a road safety issue.[41]
- Ayodhya city doesn't have regulated public transport services. E-rickshaws ply within the city as a transportation option. However, as current e-rickshaws are low speed vehicles, the lack of dedicated lanes causes crowding on the lanes.

6. Urban Planning

- Rapid urbanisation and unplanned settlements.
- Water logging problem in some areas of Ayodhya, especially during monsoon season.
- Inadequate drainage infrastructure and lack of proper planning is contributing to water logging, causing inconvenience to local residents.
- Lack of dedicated green spaces in the city, as well as open tree cover in public spaces such as sidewalks, government buildings, residential areas, etc.

38. According to urban area water supply guidelines, 135 litres per capita per day is required in urban areas.; https://ijirt.org/master/publishedpaper/IJIRT155034_PAPER.pdf;
39. https://pib.gov.in/PressReleasePage.aspx?PRID=1604871#:~:text=As%20per%20Ministry%20of%20Housing,to%20higher%20level%20by%20states.
40. Infrastructure can be aging and under developed
41. As reported during interaction with stakeholders

Box Item 2: Perception Survey, Urban Development Issues given Highest Priority by Residents

The survey indicated irregular power supply to be one of the key urban development issues faced by residents of Ayodhya. Rapid urbanisation in the city might have strained existing power systems beyond their capacity, leading to irregular supply. Many newspaper articles indicate that the city has many outdated power generation transformers that are not able to meet the increasing demands of a growing urban population. Further, this overload results in voltage fluctuations and power cuts during peak usage times. Weather events like heavy rainfall and floods add to these problems.

Respondents have ranked poor wastewater management as second in terms of urban development issues. One of the reasons is the lack of a sewerage system in the city. Inadequate or absent sewerage systems may lead to the direct discharge of untreated wastewater into water bodies, causing pollution and health hazards. Increase in urban sprawl puts additional strain on existing infrastructure. Poor management indicates lack of awareness among the public about the importance of proper wastewater management.

Overall, while traffic congestion may not be ranked as the top concern, it remains a significant challenge. Ongoing construction projects and road repairs reduce road capacity, leading to traffic delays and congestion in the city. Unplanned urban development and suburban sprawl results in long commuting distances, increasing the number of vehicles on the roads and exacerbating congestion. Other factors may include lack of public transportation, high volume of vehicles etc.

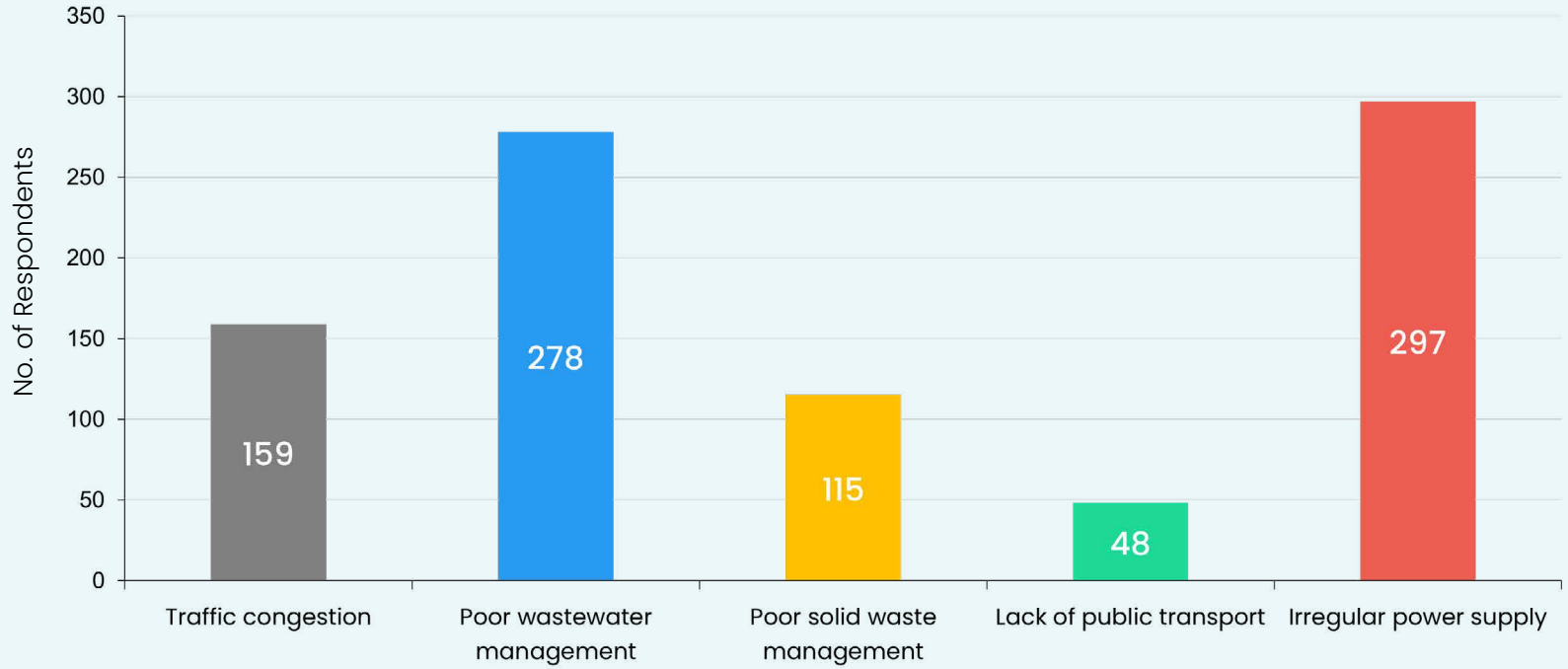


Figure 14: Urban developmental issues ranked as highest priority by respondents (n=897)

7. Disasters[42]

- In the past, Ayodhya district has experienced drought-like conditions in 2002, 2004, 2009, 2014 due to deficit rainfall. This resulted in loss of crops as the farming system is mainly rainfed during the rainy season and irrigation-based post monsoon.
- Ayodhya district falls under very severe category of flood affected regions of Uttar Pradesh.
- Urban heat island effect observed in concretised areas such as riverfront.

Box Item 3: Perception Survey, Major Environmental Issues of the City

Respondents were asked to rank four indicative environmental issues in urban areas from 1-4 to gauge the perceptive importance that they give to these issues. Ranks 1 and 2 have been grouped into higher priority brackets, and ranks 3 and 4 have been ranked as lower priority. The percentage of total responses has been calculated for each of the brackets for the four options.

Water scarcity was considered a high priority environmental issue by 568 respondents, followed by perceived heat wave by 524 respondents. This finding is in line with the need for enhanced cooling measures and rejuvenation of natural water bodies as developmental priorities for the city.

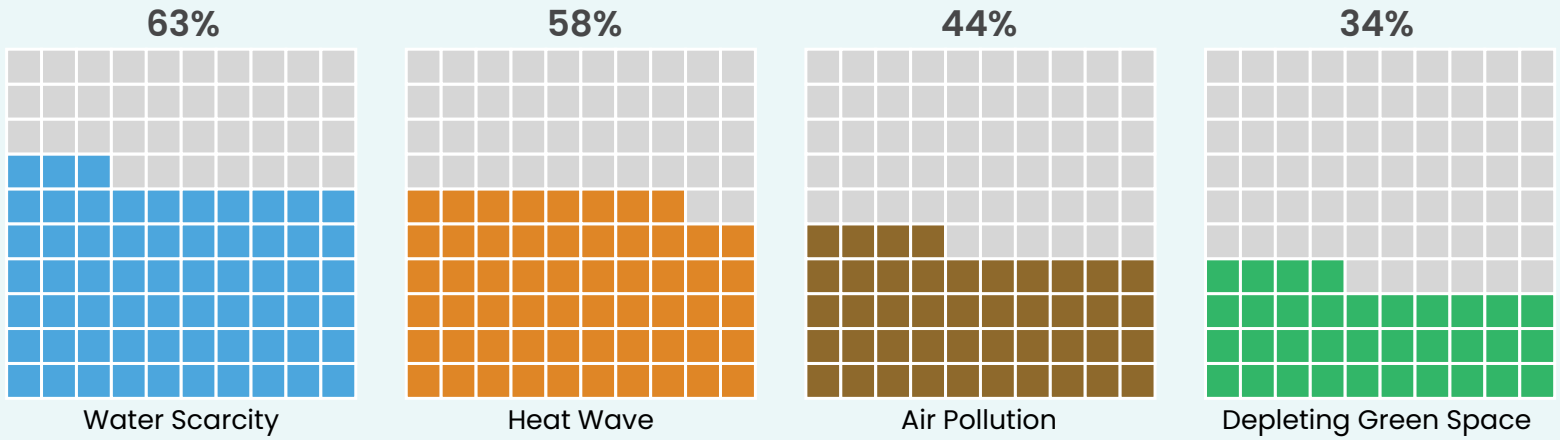


Figure 15: Responses ascribing high priority to major environmental issues as % of total responses (n=897)

42. https://upsdma.up.nic.in/UPSDMP-2022/State%20Disaster%20Management%20Plan%202022%20Part%201%20_Final.pdf

06

Recommendations for Climate Smart Activities

The recommendations proposed to make Ayodhya climate-smart factor in the initiatives planned as part of making Ayodhya a model city, as announced by the Hon'ble Chief Minister, and the city administration. Together, these activities will position Ayodhya as a uniquely sustainable and climate resilient religious tourism destination.

For baseline scenario mapping, on-ground development activities in the city that are aligned with climate action, across key sectors were mapped. Undertaking a spatial mapping exercise to delineate the currently operational and on-ground activities and infrastructure aligned with climate action in Ayodhya was undertaken as a precursor to crafting recommendations for a climate-smart urban environment. This comprehensive baseline assessment elucidates the city's existing landscape of renewable energy installations, green spaces, low-carbon transportation infrastructure, waste management systems, and other sustainable practices. thereby reflecting areas that are part of the city's policy and planning initiatives, and areas requiring further attention and investment. The baseline scenario map (See Figure 16) also helps assess the potential for spatial feasibility of climate action aligned activities in the city. The baseline scenario also helps visualize the extent of natural and physical characteristics within the planning area and their distribution.

The Vision of Climate Smart Ayodhya Map (See Figure 17) has been prepared to provide a comprehensive visualisation of possible climate-smart interventions in the city, which have been spatially marked keeping in view land ownership and classification, as understood from the Ayodhya Master Plan 2031. The map outlines sector-wise activities that can be on-grounded in the city in order to meet the short term and long-term targets of the plan. Details on the methodology for development of recommendations is given in Annexure 3.

The spatially mapped proposed recommendations are explained in further detail for each thematic area. Recommended climate-smart activities have been divided into three indicative temporal phases, Phase-I (2025 to 2027); Phase-II (2028 to 2031); and Phase-III (2032 to 2035), to provide a systematic roadmap for intervention design. The interventions are described with phased targets and cost estimates (to the extent possible). Additionally, relevant schemes and policies for each of them are also mapped.

AYODHYA PLANNING AREA

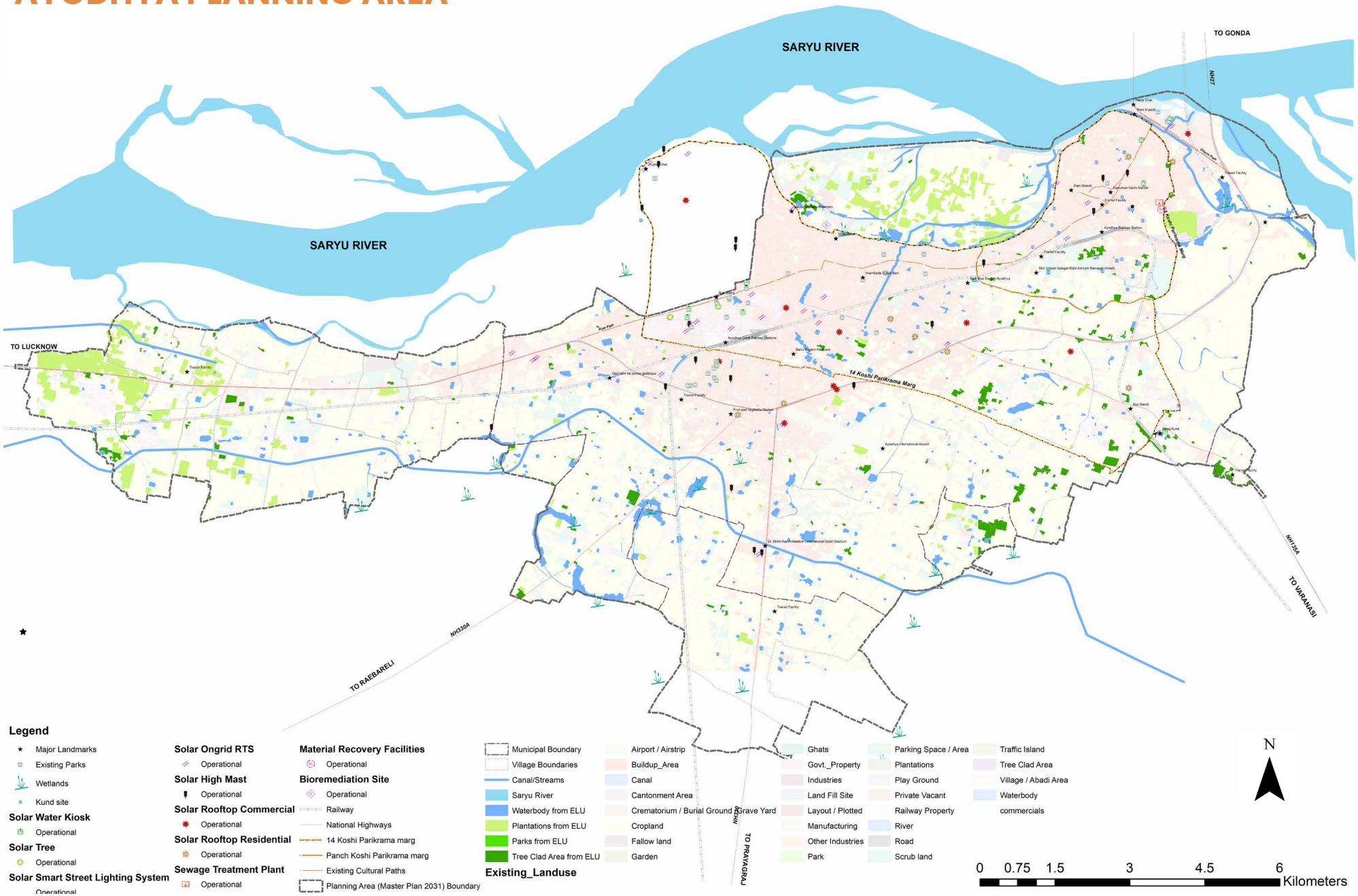


Figure 16: Existing scenario, Ayodhya Planning Area

AYODHYA CITY CLIMATE ACTION PLAN

Figure 17: Vision for climate smart Ayodhya, suggested scenario Ayodhya Planning Area

List of Sector-wise Recommendations

Sustainable Waste Management

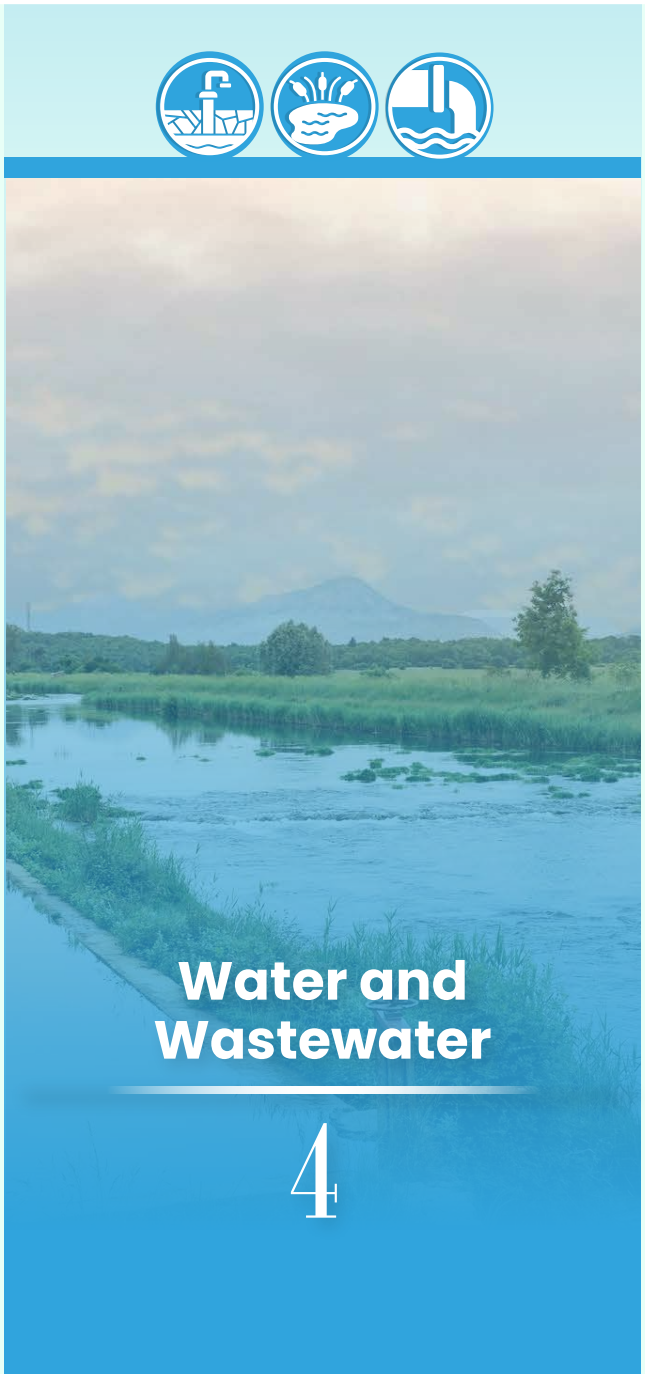
1

Transport and Green Mobility

2

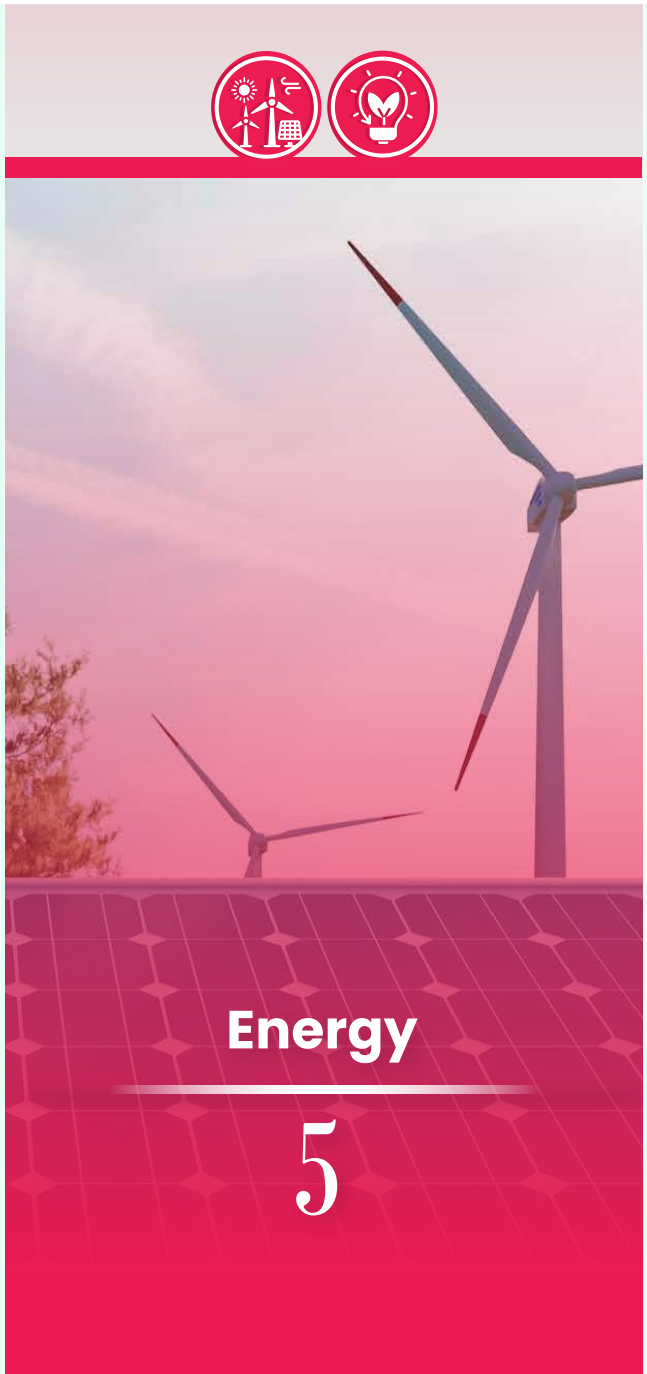
Enhancing Green Spaces and Urban Cooling Measures

3



Water and Wastewater

4



Energy

5

Industry and Livelihoods

6

1. Sustainable Waste Management

Effective waste management in cities plays a critical role in climate action by mitigating greenhouse gas emissions and promoting sustainability. Proper waste disposal, recycling programs, and waste-to-energy technologies help reduce methane emissions from landfills, while recycling and reusing materials reduce the need for energy-intensive production, and enhance circular. One of the major challenges facing Ayodhya city is waste management and treatment. However, sustainable waste management practices can significantly contribute to Ayodhya's climate resilience and its commitment to a greener and more sustainable future.

- Currently, waste segregation at source is only implemented in 15 municipality wards (of total 60), with limited continuity and inefficient segregation.
- Transportation of waste in open/uncovered trucks to the dumpsite and spilling of garbage and foul odour along the route of the trucks are common problems.
- Under developed mechanism for managing battery waste, end-of-life management of EV batteries. Currently, all damaged/phased-out batteries are discarded through the informal waste sector.
- At present, the estimated solid waste generation is 307 tonnes per day (TPD), with only a limited quantity of this waste is managed sustainably.
- Current estimated generation of livestock waste within the Ayodhya planning area is ~700 TPD.

Ensure Segregation of Waste at Source to Reduce Load at Dumping Sites

Ensure 100% segregation of waste at source

Phase 1 2025–2027	Phase 2 2028–2031	Phase 3 2032–2035
Suggested Climate Smart Activities		
1. 100% of households in urban area to be covered under door-to-door segregated waste collection 2. 25% of households in peri-urban and rural areas to be covered under door-to-door segregated waste collection 3. Local rag-pickers and informal recycling workers (kabariwalahs) to be made part of segregation process 4. 100% of institutional and tourism establishments with kitchen in Ayodhya city to segregate organic and food waste at source 5. Installation of 10-20 triple waste bins each outside all high footfall locations including tourism centres, and major market areas[38] » Ayodhya Railway Station » Ayodhya Cantt Railway Station » Ayodhya Dham Bus Station » Naya Ghat » Guptar Ghat » Awas Vikas Colony » Public Buildings	1. 50% of households in peri-urban and rural areas to be covered under door-to-door segregated waste collection 2. Continued collection of segregated waste from households and commercial establishments covered in Phase 1 3. Installation of 5-15 triple waste bins at additional location[39]: » 20 commercial areas » 40 public and semi public areas » 7 government institutions » 6 transit points, 20 historical areas	1. 100% of households in peri-urban and rural areas to be covered under door-to-door segregated waste collection 2. Continued collection of segregated waste from households and commercial establishments covered in Phase 1 and 2 3. Installation of additional 5-15 triple waste bins at strategic location: » 27 commercial areas » 42 public and semi public areas » 21 historical areas » 15 transport facility/transportation » 6 special category

38. Identified possible areas due to high commercial activity and footfall: Faizabad Chowk Market, Rekabganj Market, Fatehganj Market, Bajaja Market, Naveen Mandi

39. Quantity of triple waste bins will vary as per requirement of specific location; Waste bins should be placed at an optimum distance of 25– 250 at public places (SBM guidelines)

Ensure segregation of waste at source to reduce load at dumping sites

Estimated Cost

Cost of one triple waste bin (180L capacity)[40]: ~₹25,000 to ~₹35,000

Procurement of collection vehicles with segregated compartments

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Provision of 10% EV garbage collection vehicles for urban areas and 10% (24) EV for rural areas, with one for every village in the planning area[41] 2. Procurement and deployment of collection trucks to collect segregated food waste from all commercial establishments with kitchen	1. Provision of 50% of required EV with segregated compartments to cater to households, commercial, and other areas in the city 2. Additional collection trucks to be deployed to collect food waste from remaining commercial establishments	Provision of 100% of required collection vehicles for household waste collection in urban, peri-urban, and rural areas

40. Cost per unit indicated based on market trends
41. For rural HH, 240 battery operated carts to be procured. For urban areas, 150 collection e-vehicles with segregated compartments to be procured. Cost of 1Ev garbage van is approx 1.5 lakh (capacity 310 kg)

Monitoring and enhancing management of waste at the ward level

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
Conduct IEC campaigns to nudge the social behaviour of the citizens in favour of segregation of waste: » At the household level » In public places	1. Continued IEC campaigns towards household waste segregation and public waste bin usage 2. Equipping waste collection vehicles with GPS monitors to ascertain usage and efficient route planning	Continued IEC campaigns towards household waste segregation and public waste bin usage

Setting up of waste management park for treatment of organic waste

Management of Organic Waste

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
Identification of land and setting up of 1 waste management park of 30 TPD[42] capacity (25% of current generation of organic waste) for[43]: » Composting of organic waste collected from households and eateries » Use of the resultant manure/compost as fertiliser for trees and saplings[44]	Scaling-up capacity of waste management unit at waste management park to 60 TPD (50% of current generation of organic waste)	Scaling-up of capacity of waste management unit at waste management park to 120 TPD (100% of current generation of organic waste)

42. Total daily solid waste generation in Ayodhya city is ~307 tonnes. Of this, Biodegradable (organic) waste is considered as an average 40%. (Between 30% to 55% of Municipal solid waste is organic waste as per MoHUA, Government of India); https://mohua.gov.in/upload/uploadfiles/files/93.pdf
43. For details on location, refer to Vision for Climate Smart Ayodhya map
44. Development of the recreational zone (in green buffer) in the surroundings (park, nursery - trees, horticulture, etc.) Connected to the green mobility corridor and the bigger recreational zone

Decentralised management of organic waste

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Pilot testing of drum composting at 5 suitable temples[45,46] 2. Training and engagement of SWM workers to oversee composting activities 3. Training and capacity building of temple staff to identify and collect organic waste 4. Installation of a Bio-CNG unit[47] at one MRF centre	1. Installing compost drums in major temples in Ayodhya and Faizabad[48] 2. Continued engagement and trainings 3. Scaling up of Bio-CNG unit	1. Upscaling installation of composting drums in major temples in Faizabad as per requirement 2. Continued engagement and trainings
Estimated Cost		
The cost of a rotary drum of capacity of 550 litres is about ₹25,000 to ₹30,000[49]		

Centralised management of temple waste

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Setting up of 1 biocomposting unit of 5 TPD capacity for management of temple waste from Ayodhya[50] 2. Installing 10 compost drum each of 200 kg capacity to manage ~100kg/day organic waste	1. Scaling up capacity of composting unit to 10 TPD capacity 2. Additional 10 compost drums are installed of 200 kg capacity	Scaling up installation of composting drums as per requirement
Estimated Cost		
Cost of 10 composting drums: ~₹15,000		

45. Identified possible pilot sites: Hanuman Garhi temple, Shri Nageshwarnath Temple, Kanak Bhawan, Treta-ke-Thakur
46. Suggested activity for temples not in the vicinity of bio-composting unit
47. Subject to feasibility
48. Temples of significance identified as possible sites: Sita Rasoi, Anushthan Mandap, Kalyan Mandap & Yagya Mandap, Ashok Vatika & Pushp Vatika, Nakshatr Vatika & Durva Vatika,Aagaman Marg & Chowk, Kuber Tila
49. https://swachhbharatmission.ddws.gov.in/sites/default/files/Technical-Notes/Biodegradable_Waste_Management_Manual_English.pdf
50. Total daily solid waste generation from temples and ghats is 15 TPD, of which temple waste contributes 12 TPD, and ghats contribute 3 TPD, Ayodhya Nagar Nigam, 2023

Creating value chains for e-waste management

Management of E-waste

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Setting up of 5 pilot e-waste collection points[50] 2. Identification and appointment of 1 Producer Responsibility Organisations (PROs) to cater to old Ayodhya city through Pollution Control Board (PCB) and ULBs 3. Monthly collection of e-waste in residential areas and government offices by dedicated staff members of PRO and vehicles in Ayodhya city	1. Scaling up e-waste collection to all public schools and public colleges (Government Inter College Ayodhya, Government Girls Inter College Ayodhya, etc.) 2. Increasing scope of work of existing PRO to cater to all of Ayodhya urban area 3. Additional weekly collection of battery waste from e-rickshaw pullers and expanding zone-wise collection covering retail shops, residential areas, offices and colleges within the city	1. Scaling up e-waste collection to commercial spaces 2. Scaling up of e-waste collection through PROs to peri-urban and other rural areas

Improved management of construction and demolition waste

Management of Construction and Demolition (C&D) Waste

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
Setting up of a fenced collection and transfer station for C&D waste in the south western region of the city to facilitate management of C&D waste from within the city and other small neighbouring ULBs	Scaling up of current C&D plant capacity from 20 to 35 TPD	Setting up of second collection and transfer station

51. Pilot Collection Points have been proposed to reflect and target various categories of stakeholders and users including government employees, students, and citizens. Possible pilot collection points can be Vikas Bhawan, Dr. Ram Manohar Lohia Avadh University, Central School in Civil lines, Ayodhya Collectorate, KS Saket PG College.

Estimated Cost		
Cost of transfer stations: » Cost of land: Public land available as per ULB » Cost of weighbridge (50 tonnes capacity): ~₹5 lakhs - ~₹7 lakhs[52]	As per requirement	As per requirement

Tourism-focused Waste Reduction Initiatives

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Increasing the usage of biodegradable (dried-leaf) packaging options 2. Setting up of Solar Water Kiosks to discourage use of packaged drinking water bottles » Pilot installation of solar-water kiosks at Nayaghat (10) and Guptarghat (5)	1. Continued usage of biodegradable packaging options 2. Installation of solar water kiosks at other strategic tourist locations	1. Continued usage of biodegradable packaging options 2. Installation of solar water kiosks other strategic tourist locations
Estimated Cost		
Cost of one solar water kiosk: ~ ₹1.5 lakhs » Cost of installation at Naya Ghat: ~ ₹15 lakhs » Cost of installation at Guptar Ghat: ~ ₹7.5 lakhs		

52. https://diorissa.nic.in/weigh.pdf

Awareness and Capacity Building

Training and upskilling waste collection workers across the waste management value chain

Phase 1 (2025–2027)	Phase 2 (2028–2031)	Phase 3 (2032–2035)
Suggested Climate Smart Activities		
1. 100% of on-roll and contractual labour to be provided with capacity building through training sessions, demonstrations, and on-site learnings 2. Training modules developed and capacity building and training systems synthesised for all new sanitary workers before on-boarding. 3. Capacity building of informal waste collectors through a series of workshops by CSOs and ULBs	Continued training and capacity building activities for staff and contractual workers	Continued training and capacity building activities for staff and contractual workers

Incorporate sustainable waste management awareness with tourism activities

Phase 1 (2025–2027)	Phase 2 (2028–2031)	Phase 3 (2032–2035)
Suggested Climate Smart Activities		
1. Volunteer-based green task force (*Swachta Sarthis*) can be deployed for ensuring correct practices for waste disposal » Identification and training of 250 youth and other volunteers from colleges and clubs » Deployment of volunteers in a phased manner (bi-weekly) to high footfall areas with signage indicating best practices	1. Continuation of IEC activities as per requirement 2. Continued display of signage with zero-littering zones and waste disposal practices at hotels and other tourist accommodations	1. Continuation of IEC activities as per requirement 2. Continued display of signage with zero-littering zones and waste disposal practices at hotels and other tourist accommodations

Incorporate sustainable waste management awareness with tourism activities

Phase 1 2025–2027	Phase 2 2028–2031	Phase 3 2032–2035
Suggested Climate Smart Activities		
2. Hotels and accommodations to have signage with information on zero-littering zones and waste disposal practices: » Placement of signage in all hotels and restaurants in the city at a readable location, including in all rooms (triple waste bins, zero littering zones, discouraging single-use water bottles, etc.) » Capacity building workshops for hospitality staff (including staff in hotels, restaurants, street vendors, commercial establishments) depicting waste-segregation and best practices for disposal	Continued capacity building workshops on waste segregation and management best practices for hospitality professionals and staff	Continued capacity building workshops on waste segregation and management best practices for hospitality professionals and staff

Knowledge dissemination and awareness generation for households, institutions, and commercial outlets

Phase 1 2025–2027	Phase 2 2028–2031	Phase 3 2032–2035
Suggested Climate Smart Activities		
1. Advertising campaigns through newspapers and radio to disseminate best practices for waste segregation at the household level 2. Awareness drives in schools and community parks to showcase waste segregation rules and importance of individual action 3. Improve consumer awareness on responsible e-waste disposal through Information, Education and Communication (IEC) programme and workshops and make information readily available on local drop-off points where people associated with the institutes/colleges/offices can deposit the e-waste	Continued IEC activities	Continued IEC activities

Existing Schemes and Programmes

- The development of waste infrastructure can be supported by initiatives under the Swachh Bharat Mission Urban 2.0.
- Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) can be tapped into for the construction of community-based composting facilities, waste collection and segregation pits.
- Corporate Social Responsibility (CSR) funding and Panchayat-Private-Partnership (PPP) models can help to develop and operate infrastructure like plants, segregation yard, plastic-alternative enterprises, marketing, procurement of e-vehicles for waste transport, etc.
- Further, CSR support will be crucial in increasing awareness, training, and capacity building of all stakeholders involved in the production of alternative products for plastic, composting processes and to promote sustainable consumption behaviour at the individual level.
- Suggested interventions for management and reduction of plastic waste (i.e., Single-use plastic free Ayodhya) can be aligned with existing activities that have been taken up as part of RACE 3.0 SUP Free Ayodhya Campaign initiated by the Department of Environment, Forest and Climate Change and the Department of Urban Development, Government of Uttar Pradesh.
- Solid Waste Management Rules, 2016 & Amendment, 2018.
- E-Waste Management Rules, 2016 and Implementation Guidelines for E-Waste (Management) Rules, 2016, Central Pollution Control Board (CPCB).
- Construction & Demolition Waste Management Rules, 2016.

Key Departments

- Ayodhya Development Authority
- Ayodhya Nagar Nigam
- Uttar Pradesh Pollution Control Board (UPPCB)
- District Administration
- Department of Rural Development
- Panchayati Raj Department
- Department of Agriculture
- Jalkal Vibhag, Ayodhya
- Public Works Department, Ayodhya

2. Transport and Green Mobility

Ayodhya is a regional transportation hub with a road network connecting it to major districts through national and state highways. With the growing population and the rising demand for transport and mobility in Ayodhya, it presents many opportunities to upgrade to a multimodal transport system, which can potentially minimise greenhouse gas (GHG) emissions. Urban local bodies are critical in the e-mobility transition, and the two vital areas that need a boost are financing for sustainable mobility, and strengthening of governance institutions. Ayodhya has also been identified as one of the cities to get a comprehensive mobility plan by 2025, with specific focus on encouraging NMT access and usage.

- Ayodhya has the scope to develop a robust public transit system for intra-city travel. Currently, people rely on auto rickshaws, e-rickshaws, omni vans and jeeps transit options.
- Essential road facilities such as medians, and footpaths are underdeveloped.
- While a number of e-rickshaws serve commuter needs, there are no public charging stations in the city. Illegal charging of electric 3-wheelers at unregulated points is a safety hazard and can also result in monetary losses to discoms and the city.
- The current paucity of charging stations is a probable deterrent to EV adoption in the city.

Introduction of EV mini buses to the public transport system

Introducing Electric Public Vehicles (Inter and Intra City)[53]

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. 10 EV mini buses connecting tourist attractions to cater floating population of tourists[54] 2. Enhancing sustainable public transportation options for residents through procurement of 10 EV mini buses	Additional EV buses covering new routes added to the fleet as per requirement	Additional buses added to the fleet as per requirement
Estimated Cost		
Cost of 30 seater EV bus: ~ ₹1 crore[55]		

Setting up of dedicated parking spaces for EVs in the city

Enhancing Infrastructure for Private EVs

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
Existing public spaces in the city to be identified and parking spaces reserved for EVs (2- and 4-wheelers)	All new public/parking spaces open across the city, to have strategic reserved spots for EVs	

53. Under UP-EV policy 2022, The State Government targets 100% transition of public transport to EV by 2030).
54. Example: Naya ghat to Ghanta chowk Ayodhya via Parikrama marg; Ayodhya Dham bus station to Hanuman Garhi
55. Cost indicative of current market prices of EV bus models, not considering cost adjustments from State-level subsidies or CFA

Setting up a network of strategic EV charging stations in prominent locations[54]

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
Setting up EV charging stations in strategic locations[57]: » Along NH 27 towards Lucknow - 2 charging stations » Navya Ayodhya - 1 » On NH 27 towards Gorakhpur - 1[58]	1. Setting up EV charging stations at strategic parking locations 2. Scaling up EV charging stations at strategic locations » Towards Sultanpur - 2 » Acharya Nagar - 1 » Civil Lines -1	Setting up of additional EV charging stations
Estimated Cost		
Cost of setting up 1 public charging stations: ~₹20 lakhs[59]	As per requirement	As per requirement

56. Proposed locations for EV Charging Stations is based on priority corridors/areas, potential vehicular footfall, easy accessibility, land availability and appropriate distance (as per the suggested standards for EV charging stations by the Ministry of Power, Government of India)
57. For details on location, refer to Vision for Climate Smart Ayodhya map
58. For details on location, refer to Vision for Climate Smart Ayodhya map
59. Cost of public electric charging station as per prevailing market rates

Enhanced coverage of NMT corridors across the city and linking of blue and green infrastructure within and around Ayodhya city

Planning for Non-motorised Transport Infrastructure (Bicycle and Pedestrian Pathways/Tracks)

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Construction of Green Mobility (NMT)[60] corridors connecting strategic locations (recreational spaces, tourist places, central market areas, administrative areas, cultural and religious zones, etc.)[61] 2. Bicycling and pedestrian path connecting key nodes (wetlands, riverfront, green buffer) » Recreational zone - 4.5 km » Along Ghaghara Canal - 30% (7.4 km) » Along 14 Kosi Parikrama Marg - 40% (13.2 km)	1. Expansion of Green NMT corridor and maintenance of existing corridor » 1 connecting corridor between Parikrama Marg to Ghaghara Canal - 2.3 km » Proposed corridor along Ghaghara canal - 30% (7.4 km) » Along 14 Kosi Parikrama Marg - 40% (13.2 km) 2. Regular maintenance and upkeep of NMT corridors	1. Continued expansion of Green NMT corridor and maintenance of existing corridor 2. 1 connecting corridor between Parikrama Marg to Ghaghara canal with - 2.3 km » Proposed corridor along Ghaghara Canal - 40 % (9.9 km) » Along 14 Kosi Parikrama Marg - 20% (6.6 km) 2. Regular maintenance of existing NMT infrastructure
Estimated Cost		
Cost of construction of cycling track of 25.1 km[62] : ~ ₹35.1 crores (~140 lakhs per km)	Cost of construction of cycling track of 22.9 km: ~ ₹32 crores (~140 lakhs per km)	Cost of construction of cycling track of 18.8 km: ~ ₹26.32 crores (~140 lakhs per km)

60. Subject to land availability, any updates to the proposed land use category as per the updated Master plan that is under prepration
61. For details on location, refer to Vision for Climate Smart Ayodhya map
62. The cost of per kilometre development of cycle tracks includes all related costs such as excavation, dismantling, preparation of sub bases, backfilling, etc. These include a 5.0m wide independent track and 2.5m wide cycle track on both sides of new road development or on either side of an existing road; https://shaktifoundation.in/wp-content/uploads/2017/06/NMT-Guidelines.pdf

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Setting up pick-up and drop kiosks, and parking spots points at 15 key tourist locations 2. Setting up of public bicycle hire and parking points at strategic locations along the Green NMT corridor[63]	1. Setting up bicycle parking space at major areas such as, outside major parks, busy commercial areas, colleges, and key tourist locations 2. Setting up of 19 additional bicycle hire and parking points at strategic locations along the Green NMT corridor (refer Figure 17)	Additional bicycle hire points set up as required
Estimated Cost		
1. Cost of cycle parking roofing shed: ~₹150 per sq. ft. 2. Cost of bicycle: ~ ₹4,500 per unit		

Existing Schemes and Programmes

- UP Electric Vehicle Manufacturing and Mobility Policy, 2022
  - Fiscal Incentives: Charging stations to be provided with one time capital subsidy on eligible fixed capital investment for service providers at the rate of 20% subject to maximum INR 10 lakh per unit to first 2000 charging stations.
  - 100% registration fee and road tax exemption to buyers (during the policy period).
  - One time purchase subsidy as an early bird incentive[64] to buyers through dealers over a period of 1 year – E-goods Carriers: @10% of ex-factory cost up to ₹1,00,000 per vehicle; 2-wheeler EV: @15% of ex-factory cost up to ₹5000 per vehicle; 3-wheeler EV: @15% of ex-factory cost up to ₹12000 per vehicle.

63. As per 'The public bicycling toolkit' developed by Ministry of Urban : *AREA- For every 5 sq. km area there should be 1000 bicycles; POPULATION- For every 30 users there should be 1 bicycle. Initially, fewer bicycles can be deployed and the number might be scaled up or down, depending on the market demand.
64. Subsidies provided by the government are subject to periodic changes both in terms of the quantum and number of beneficiaries. Hence, subsidies mentioned in any section of this plan are only indicative, and need to be confirmed at the time of procurement.

  - Subsidies for e-rickshaws can also be availed under the Faster Adoption and Manufacturing of Electric Vehicles in India Phase II (Faster Adoption and Manufacture of Hybrid and Electric II Scheme).
- Smart City Mission
  - Promotion of Transit Oriented Development (TOD)[65].
  - Initiatives like "Cycle4change" and "Transport4all" in partnership with different stakeholders (NGOs, corporates and community) can help promote NMT network in the cities.
  - CSR funding and Panchayat-Private-Partnership (PPP) models can support projects like Public Bicycle Sharing and Smart Roads, paving the way for citizens to explore alternative and inclusive forms of transportation.
- Green mobility NMT corridor infrastructure can be leveraged under Atal Mission for Rejuvenation and Urban Transformation (AMRUT).
- Vehicle Scrappage Policy 2022
  - Incentives to scrap old vehicles, including discounts on the purchase of new vehicles against a scrappage certificate.
  - Rebate of 50 percent in taxes and penalties for scrapping vehicles older than 15 years and 75 percent waiver for vehicles older than 20 years.

Key Departments

- Town and Country Planning Department
- Ayodhya Development Authority
- Ayodhya Nagar Nigam
- Public Works Department, Ayodhya

65. http://www.nagarnigamayodhya.in/pages/en/newtopmenu/schemes/central-sponsored-schemes/en-smart-cities-mission

3. Enhancing Green Spaces and Urban Cooling Measures

- The current built up area within the Ayodhya planning area is 3,282.25 hectares, which might increase owing to the infrastructural and development projects in the pipeline (eg.: The city has a number of hotels being developed and by the end of 2024, 70 new hotels/lodges are planned to be developed).
- The Ayodhya Master Plan has planned 13.38% of the city's land use to come under open and green spaces by 2031. However, as per the current land use pattern, only ~ 3,200 ha of the area is green space.
- The widening of arterial roads and other infrastructural projects have also resulted in the felling of trees. Hence, to restore diverted green spaces and expand the area of green spaces in the city, targeted interventions are required.
- The maximum temperature in the region is projected to increase by 1.2°C to 2.6°C under RCP4.5 and 1.3°C to 5.0°C under RCP8.5 scenario (See section on Climate Variability). Rising temperatures can cause an increase in usage of air conditioning in indoor spaces in certain economic sections. The aggregated country-level space cooling demand is projected to eleven fold by 2037-38 compared to 2017-18[66], signalling the need to re-think building and construction standards in upcoming urban centres like Ayodhya.
- The city has an existing network of blue and green spaces, such as kunds, wetlands, and parks, that can be utilised for enhancing green spaces within the city.

66. India Cooling Action Plan 2019, Government of India. Available at http://ozonecell.nic.in/wp-content/uploads/2019/03/INDIA-COOLING-ACTION-PLAN-e-circulation-version080319.pdf

Urban Greening: Dedicated Green Spaces within the City through Community Engagement

Enhancing organised green open spaces (parks, gardens, and playgrounds)

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Documentation of all public and community parks in the city to ascertain tree-coverage 2. Increase coverage of native trees varieties in parks » Plantation drive in 5 public parks in the city[67] 3. Restoration[68] of 3 public parks in Kaushalpuri Phase 2 (refer Figure 17)	1. Maintenance of saplings and trees planted in Phase 1 2. Plantation drives in 20 more public parks in the city[69]	Expanding plantation drives in remaining parks in the city

Identification of volunteers for creating Green Steward Teams in the city[70]

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. ~200 volunteers identified from various community institutions including clubs, religious centres, youth clubs (active in colleges), NGOs, etc. 2. Training and capacity building of volunteers	1. ~200 additional volunteers identified 2. Continued training and capacity building sessions organised	

67. For details on urban greening, see annexure 6
68. Restoration would include cleaning, tilling of land, construction of boundary wall, paved walking paths and plantation with tree guards
69. No of trees planted will depend on baseline analysis undertaken in phase 1
70. Community led upkeep of saplings/trees planted as part of district-level plantation drive to promote resident ownership of ecological assets. (Eg. voluntary green stewards at the ward/colony level to work in tandem with the regional horticulture office for monitoring sampling health).

Increasing the survival rate of saplings and plants through adoption of scientific care methods and community participation

Phase 1 2025–2027	Phase 2 2028–2031	Phase 3 2032–2035
Suggested Climate Smart Activities		
1. Community participation: » Adopt-a-tree campaign to be piloted in the city through engagement of government officials » Creation of monitoring database through geotagging of adopted saplings » 5 officials from each district office and ULB office assigned to overlook the health and maintenance of 2 saplings[71] each 2. Third-party audits to assess the success of plantation drives and ascertain survival rates	1. Continued activities under Adopt-a-tree Campaign 2. Annual third-party audits of city-wide plantation activities since 2021	Biennial third-party audits of plantation drives occurring after 2026

Installing vertical gardens or rooftop garden in community and government buildings

Phase 1 2025–2027	Phase 2 2028–2031	Phase 3 2032–2035
Suggested Climate Smart Activities		
1. Pilot installation of direct green facade in 2 government buildings 2. Installing indirect green facade/ vertical screen green facade in any one government building	1. Installing direct green facades in all suitable government buildings 2. Carrying out maintenance activities of all installed gardens	Continued maintenance of installed gardens.

71. Within a 50 m radius of their office or residence, and to report to the concerned department if additional care is required.

People's Biodiversity Register

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Constitution of Biodiversity Management Committees (BMC) in 21 villages[72] in the planning area 2. Development of People's Biodiversdity Register (PBR) 3. Build awareness amongst community and all stakeholders	Updation of People's Biodiversity Register	Updation of People's Biodiversity Register
Estimated Cost		
1. Cost of setting up BMC: ~₹1,10,000[73] 2. Cost of preparation of PBR: ~₹2,30,000 *Total cost: ~₹3,40,000*		

72. See Annexure 7
73. Guidelines for Operationalization of BMCs, National Biodiversity Authority 2013. Available at http://nbaindia.org/uploaded/pdf/Guidelines%20for%20BMC.pdf . The cost estimation figure is taken for setting up an BMC at the district level, and for government numbers available for the year 2013. Cost estimate will go up once adjusted for inflation and any updates in scope of work of BMCs.

Cool Pavements and Carriageways

Planting shade trees along all arterial and sub-arterial city roads[74]

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Identify locations for planting and plantation of saplings along the 12.94 km arterial road (Ram Path) 2. Plantation along NMT corridors constructed in Phase 1(See section on "Green Mobility"): » Plantation of 1,000 plants along ~25 km NMT corridors Carbon sequestration potential: ~5,600 tCO_2e - ~10,000 tCO_2e sequestered in 15-20 years	1. Planting of saplings for native shade trees along all main roads in the city[75] 2. Continued plantation along NMT corridors: » Plantation of ~920 plants along 23 km NMT corridors constructed in Phase 2 Carbon sequestration potential: ~5,152 tCO_2e - ~9,200 tCO_2e sequestered in 15-20 years	1. Continuation of Phase 2 activities and extending plantation drive to all sub-arterial roads in the city 2. Continued plantation along NMT corridors: » Plantation of ~1,760 plants along 44 km NMT corridors covered in Phase 3 Carbon sequestration potential: ~9,856 tCO_2e - ~17,600 tCO_2e sequestered in 15-20 years
Estimated Cost		
Cost of plantation with tree guards: ~ ₹12,70,000	Cost of plantation with tree guards: ~ ₹11,68,400	Cost of plantation with tree guards: : ~ ₹21,84,400

Construction of cool pavements

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Upgradation of existing pavements, parking lots, side-walks and roads to reflective pathways[76]	1. All future pathways constructed to be reflective pathways 2. Formulation of monitoring committee with respect to evaluation of reflective pavement application	

74. Shade from vegetation cover can bring down temperatures by 2-3 degree celsius
75. Based on feasibility and availability of space
76. Reflective pavements decrease the pavement temperature approximately by 8 °F.

2. Promote use of light coloured or white top reflective pavement applications with a layer of 50 mm thick[77] cement concrete		

Climate-responsive Building Codes

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Commercial establishments and public offices to replace existing water fixtures with efficient fixtures 2. Promote adoption of solar water heating system in hotels, residential buildings (built on a plot size of 500 sqm and above) government buildings, schools comercial spaces **As per Energy Conservation Building Code (ECBC) guidelines solar water system should be capable of meeting 20% of the hot water demand*[78]	1. Continued adoption of efficient water fixtures in public buildings and commercial establishments 2. Continued adoption of solar water heating systems in commercial establishments and residential buildings	

77. Total paved area of the site under parking, roads, paths or any other use should not exceed 25% of the site area or net imperviousness of the site not to exceed the imperviousness factor as prescribed by the NBC 2005 (BIS 2005b); https://www.naredco.in/notification/pdfs/Building%20Guidelines%2046.pdf
78. https://beeindia.gov.in/sites/default/files/BEE_ECBC%202017.pdf

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035

Suggested Climate Smart Activities

1. Curtailing the use of reflective glass facades in future constructions and developments
2. Promoting the use of high quality double glass with special reflective coating in new constructions[79]

Existing Schemes and Programmes

- Plantation activities can be carried out through provisions under:
  - The Nagar Van Yojana promotes urban forestry by creating Nagar Vatika (1-10 ha) and Nagar Van (10 ha and above) in cities, focusing on green spaces and aesthetics. Grants are limited to 50 ha, with funding up to ₹4 lakhs per hectare. At least two-thirds of the area must be under tree cover and may include biodiversity parks, butterfly conservatories, smriti vans, herbal gardens, and waterbodies.[80]
  - Green UP Mission: Social forestry and green belt development is being done in forest blocks, government land, roadside, canal side and along railway lines, covering both urban and rural areas. The Vanavaran Samvardhan Yojana is being implemented in reserve forest areas with financial support from National Bank for Agriculture and Rural Development (NABARD).
  - Upvan Yojna aims at improving green cover. The government is providing saplings and tree cuttings for plantation. Urban Local Bodies will receive between Rs. 1.5 crore and Rs. 5 crore depending on the scale of the project.
  - The Heritage Tree Adoption Scheme focuses on preserving endangered trees.
  - Tree plantation campaign 'Ped Lagao Ped Bachao Jan Abhiyan 2024' along river banks by UP Government.
  - 'Trees Outside Forests in India' initiative by MoEFCC.
- Development and maintenance of green spaces can be taken up under Atal Mission for Rejuvenation and Urban Transformation (AMRUT). There is a maximum allocation of 2.5% of project cost for development of parks.[81]

79. https://www.naredco.in/notification/pdfs/Building%20Guidelines%2046.pdf; https://mohua.gov.in/upload/uploadfiles/files/Energy_Efficiency.pdf
Guidelines to be followed for building and construction projects to ensure sustainable environmental management under environment impact assessment notification, 2006, calls for use of glass be reduced by up-to 40% to reduce the electricity consumption and load on air-conditioning
80. Nagar Van Yojana (Revised Guidelines Version), Ministry of Environment, Forest, and Climate Change. Available at https://mpforest.gov.in/img/files/Nagar_Van_Scheme_Guidelines_English.pdf
81. https://mohua.gov.in/cms/amrut.php

- Annual budgeting under UP State Compensatory Afforestation Fund Management and Planning Authority Fund (State CAMPA fund) can be directed for:
  - Afforestation, enrichment of biodiversity, improvement of wildlife habitat, and soil and water conservation activities in the planning area.
  - Plantation activities can be aligned with MGNREGS and the local community can also be engaged in providing 'shramdaan'.
- The Sub-Mission on Agroforestry under the National Mission on Sustainable Agriculture can be leveraged to:
  - Avail ₹28,000 per ha of agroforestry plantation.
  - Assistance for plantations can be availed in the year-wise proportion of 40:20:20:20 for four years.
- The "Uttar Pradesh Adoption of Parks 2024" promotes the public-private partnership to enhance the upkeep of urban parks. This scheme can be leveraged for considerations under community-led greening initiatives through maintenance agreements with Resident Welfare Associations, Market Associations, and other relevant bodies.[82]
- Programmes by the National Biodiversity Authority and Uttar Pradesh State Biodiversity Board can be tapped into for training and capacity building of BMCs.
- The Pradhan Mantri Awas Yojana (PMAY) and the Eco-Niwas Samhita Scheme can boost the green residential buildings initiatives at city level.
- Skill development and training programme of the Central Institute of Medicinal and Aromatic Plants, Lucknow can be helpful in setting up Arogya Van in the planning area.
- Ayodhya Green Fund.
- CSR funds for purchase of saplings, organising plantation drive, erection of tree guards to ensure protection of saplings can be availed.

Key Departments

- Department of Environment, Forest, and Climate Change
- Divisional Forest Office
- Department of Horticulture
- Department of Urban Housing and Development
- Department of Agriculture

82. https://urbandevelopment.up.nic.in/data/Govt_Orders/NV-5-2443[07-06-24]-GO.pdf

4. Water and Wastewater

- The city's location on the banks of River Saryu positions Ayodhya in a water positive zone. 100% of the city's drinking water supply is through groundwater.
- Tap connection coverage in the city is still limited (See section on Water, Planning Area Profile). The current annual water consumption demand met through piped water supply is ~9,975 million liters.
- The per capita demand for water will significantly increase in the coming years due to the rising population (permanent and floating). By 2031, the total demand of potable water can go up to ~161 MLD.
- During peak tourism season, the total water demand is estimated to be an additional 47 MLD[83].
- The city has operational STPs of capacity of 18 MLD. However, this capacity does not fulfill the city's current requirement of around ~50 MLD domestic wastewater treatment[84].
- At Ayodhya ghat areas, total 4 sewage drains (Rajghat Nala, Rin Mochan Nala, Gola Ghat-1, Gola Ghat-2) are discharging directly in Saryu river without treatment[85].
- Presently, there is no separate channel for collection of storm water and sewage generated in Ayodhya.

83. Peak tourism season water demand has been (months of August to September) estimated for average per day tourism inflow of ~3,53,000 persons; https://uptourism.gov.in/en/post/Year-wise-Tourist-Statistics
84. Assuming the 135 LPCD benchmark of urban water supply is met by 2031 in Ayodhya, for a projected population of 11,94,206 people (Ayodhya Master Plan, 2020), wastewater generation will amount to ~128 MLD.
85. http://www.uppcb.com/pdf/RIVER-SARYU.pdf

Groundwater Management

Phased construction of rainwater harvesting structures across the city

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
Installation of rainwater harvesting (RwH) structures in government and panchayat buildings of 30 villages of the Ayodhya Planning Area[86]	1. Scaling up of RwH structures in primary school, community halls, hotels/ homestays in all 65 villages part of the Ayodhya Planning Area[87] 2. Mandatory construction of RwH structures in all new buildings	1. Installation of RwH structures in residential buildings above a plot size of 300 sq.m.[88] 2. Mandatory construction of RwH structures in all new buildings
Estimated Cost		
Cost of installation of RwH system with 10 m^3 tank storage pit capacity: ~ ₹35,000 per unit		

86. As per Model Building Bye Laws (MBBL)2016 , all buildings having a plot size of 100 sq.m. or, more mandatorily include the complete proposal of rainwater harvesting; States/ UTs have been advised to enable Rural Local Bodies/Panchayats to utilise 15th Finance Commissions tied grants to take up rooftop rainwater harvesting in Government buildings like panchayat, bhawans, Anganwadis, schools, Primary Health Centres etc. https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1897697
87. This work can be funded under MGNREGA for rural areas.
88. https://sansad.in/getFile/loksabhaquestions/annex/11/AU3459.pdf?source=pqals

Management and Rejuvenation of Water Bodies

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Rejuvenation of 4 wetlands (total wetland area under rejuvenation[90]: ~89 hectares.)[91]: » Inland manmade (tank/pond) - 2 » Natural (lake/pond) - 3 » Oxbow lake - 1 » Riverine - 2 2. Softscaping of 10 existing kunds » Desilting and cleaning of tanks » 100-200 saplings planted around each kund with a focus on native tree species in line with ecosystem considerations » De-concretisation of land around plantations to allow water seepage » Ban on idol-immersion in kunds » Construction of stormwater channels with filter chambers	1. Regular maintenance and cleaning of existing wetlands and restoration of additional wetlands as per requirement 2. Promotion of community engagement in wetlands conservation and management efforts 3. Softscaping of 15 additional kunds 4. Maintenance of existing kunds and kunds restored in Phase 1	1. Periodic maintenance of kunds and wetlands 2. Continued community engagement in wetlands conservation and management

Management of water bodies[89]

89. Ayodhya city has around 44 'kunds', which are historic water catchment structures constructed in limited and closed areas. Proper restoration of these water bodies can augment water conservation at the local level.
90. Wetlands were identified as per information collected from District Forest Office, Ayodhya. Refer to annexure for complete list
91. Refer to Vision for Climate Smart Ayodhya Map for exact locations

Enhancing Wastewater Infrastructure

Enhancing storm water infrastructure[92]

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. City wide assessment of storm water drains including catchment area, their boundaries (originating point and final destination point), length of drains 2. Development of scope of work, and identification of areas for construction of trenches 3. Installation of trench grates along the curb of the road in Civil Line area (government buildings) to connect with Civil Line Talab 4. Maintenance (desilting, de-weeding, cleaning of obstruction, debris and blockage) & fencing of drains	1. Construction of dedicated storm water drainage network to separate stormwater and sewage water drains for effective channelization 2. Installation of 50 percent trench grates along the curb of the road in residential area and link roads (Zone 1, 2 & 3) 3. Bi-annual zone-wise cleaning and maintenance of trench drains or as required	1. Trench grates to be installed in remaining zones (Zone 4, 5 and Zone 6) covering all commercial and residential area (100%) 2. Continued maintenance of all trenches and drains
Estimated Cost[93]		
As per requirement	As per requirement	As per requirement

92. As per CPHEEO manual, urban drains (minor system) are recommended to have a design capacity of 1-to-5- year Average Recurrence Interval (ARI) storms as per different land-uses and city type :https://cdn.cseindia.org/attachments/0.92090700_1693893028_dk_urban-stormwater-management.pdf
93. Earth work in excavation of trenches or drains Beyond 4000 mm to 6000 mm below ground level would cost = ~Rs. 27,702; Laying of R.C.C. pipe (depending on size of pipe) would cost per 1500 mm dia) = ~Rs.1200; Labour charges (beyond 1.0 M. up to 2.0 M trench width): ~ Rs.730 https://www.wburbanservices.gov.in/upload_file/file_doc/S_D_Total_Book.pdf

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Repair of existing drainage network (primary, secondary, tertiary) 2. Construction of new drains and conversion of untrained drains into pucca drains with additional provisions to carry 15-20% discharge 3. Proposing slit traps or trash screens (50 percent) at 2 outfall points of drains to prevent discharge of floating matters into the Saryu River 4. Implementation of 50 percent bio toilets (biodigester) in major tourist focus areas like parks, Naya Ghat, Ayodhya Bus Station, Tedhi Bazar 5. Regular maintenance of bio-toilets	1. Maintenance of existing drainage network 2. Installation of silt traps or trash screens at remaining 2 outfall points (100%) of drains to prevent discharge of floating matters into the Saryu River 3. Increasing 100% coverage of bio-toilets at Ayodhya Bus Station, Tedhi Bazar, Amaniganj and outside Ayodhya Railway Station 4. Regular maintenance of bio-toilets 5. Setting up of DEWATS in 24 villages	1. Maintenance of drainage infrastructure 2. Construction of 1 STP* of 30 MLD capacity 3. Maintenance of STPs 4. Maintenance of existing DEWATS and addition of new DEWATS as per future population demand ** Additionally, various wastewater treatment technologies like phytoremediation, eco-bio blocks, and rotating biological contactors can also be explored in future*
Estimated Cost		
1. Construction cost of bio-toilet = ~₹20,000 per unit depending upon material of construction[94] 2. Cost of silt traps/trash screens: As per requirement	Cost of 250 KLD DEWATS*: ~₹50,00,000 **Cost of construction of DEWATs will vary based on technology and capacity requirement*	

94. SBM guidelines: http://swachhbharaturban.gov.in/writereaddata/SBM_GUIDELINE.pdf

Existing Schemes and Programmes

- Development of rainwater harvesting systems can be carried out through provisions and resources made available through Jal Shakti Abhiyan: Catch the Rain Campaign. As per the Model Building Bye Laws, it is mandatory to install rainwater harvesting structures in government buildings.
- Annual budgets under MGNREGA and Watershed Development Components under Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) can be leveraged for watershed development activities.
- Projects related to stormwater drainage, septage management and sewage can be leveraged through AMRUT. The Central Assistance (CA) for the projects will be in three installments of 20:40:40 of the approved cost.
- Rejuvenation and conservation of water bodies can be taken up under the Amrit Sarovar Abhiyan. The funds for the Amrit Sarovar Mission can be utilised from MGNREGS, XV Finance Grants from the Commission (both tied and untied), as well as schemes like PMKSY-WDC (Watershed Developement Component) or similar programs from State or Central Governments, either individually or in combination.[95]
- Wastewater Management Projects:
  - Sewage Treatment Infrastructure can be taken up under initiatives like Namami Gange. There is no state-wise allocation under the Namami Gange Programme. However, the specific amount is released by National Mission for Clean Ganga (NMCG) to various agencies for implementation of projects. Clean Ganga Fund (CGF) funds the program under the Namami Gange and coordinates and oversees the implementation of the projects sanctioned.[96]
  - Setting up STPs can also be leveraged under Swachh Bharat Mission (Urban) 2.0.
  - Sewage network management and storm water drainage infrastructure development are components under Atal Mission for Rejuvenation and Urban Transformation (AMRUT 2.0). Funding for the projects will be shared by Centre, States and ULBs.
    - Cities having population up to 10 lakh: Half of the project funds by centr
- UP State's annual budget under the Irrigation Department can be channelled for gram panchayat-level water body conservation and restoration activities.
- Sustainable groundwater management in gram panchayats can be supported through initiatives like Atal Bhujal Yojana (ATAL JAL). Funds under the scheme shall be provided to the states as grants-in-aid. The scheme is already being implemented in 10 districts of UP.[97]
- Corporate/CSR can be encouraged to 'Adopt a water body' to contribute to the maintenance and upkeep of water bodies and wells.
- Watershed Development related activities can be promoted through Watershed Development Fund by National Bank for Agriculture and Rural Development (NABARD).

Key Departments

- Irrigation and Water Resources Department, Ministry of Jal Shakti
- Uttar Pradesh Department of Land Resources
- Regional Pollution Control Board
- Department of Rural Development
- Department of Forest
- Ayodhya Nagar Nigam

95. https://ncog.gov.in/AmritSarovar/AmritSarovarGuidelines.pdf
96. https://nmcg.nic.in/cgf/about_cgf.pdf
97. https://jalshakti-dowr.gov.in/atal-bhujal-yojana/

5. Energy

The majority of electricity in the city is supplied by Madhyanchal Vidyut Vitran Nigam Ltd which in turn procures electricity from Uttar Pradesh Power Corporation Ltd (UPPCL).[98] The two major substations that supply power to Ayodhya City are 132 KV Darshan Nagar Station, and 220 KV Sohawal Station

98. http://mvvnl.in/post/en-about-mvvnl?cd=MQA0AA%3d%3d

Enhancing the Use of Renewable Energy

Increase the share of renewable energy (RE) generation by advancing rooftop and ground mounted solar installations, and other sources of RE installations

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Installation of solar or bio-solar rooftops in existing government and Panchayati Raj Institutions (PRI) within Ayodhya Planning Area (to ensure 100% coverage) 2. Solar rooftop installation of 4 MW in » High density residential areas » Hotels, guest houses, lodges, and other tourists' accommodations 3. Battery storage for RE to be promoted to provide power in government offices/ buildings	1. Installation of solar panels[99]: » Proposed recreational green zone » Ayodhya International Airport 2. Scaling up of solar or bio-solar rooftop installations in zones earmarked under public/semi public, transit areas and other government land 3. Scaling up solar rooftop installation to » High density residential areas » Increased focus on tourist accommodations to employ grid-connected solar rooftop systems » All new constructions at upcoming residential townships of Navya Ayodhya » Suitable pakka houses in peri-urban and rural areas within Ayodhya Planning Area 4. Scaling up solar rooftop installation at public spaces, hotels/lodges/dharamshala	1. All newly constructed government and public buildings to have rooftop solar systems installed 2. All newly constructed tourist accommodations (including hotels, lodges, and guest houses) have grid-connected solar rooftop systems

99. Potential and strategic locations are identified in the existing public/semi-public/government land. Based on availability of land and future construction, installations of solar power plants can be carried out in multiple public/government owned lands in Ayodhya.

Upgradation and installation of solar street lights

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Upgrading all street lights to solar LED street lights, or solar LED high mast 2. Installation of solar street lights along key circuits 3. Installation of solar street lights along NMT corridors	Installation of solar high mast in strategic locations around schools, residential buildings, parks and ghats	Maintenance of solar LED street lights and solar LED high masts

Promoting decentralised renewable energy (DRE) framework in peri-urban areas for small industries and creation of local entrepreneurs

Phase 1 2025-2027	Phase 2 2028-2031	Phase 3 2032-2035
Suggested Climate Smart Activities		
1. Replacing 25% of existing diesel pumps with solar pumps 2. Installation of solar street lights in peri-urban and rural areas around Ayodhya city 3. Installation of solar rooftop on all Panchayati infrastructure (including schools, PHCs, and gram offices) 4. Uptake of decentralised solar applications at household level including lighting, water heating	1. Replacing remaining pumps (100%) with solar pumps 2. Uptake of solar rooftop setup for 50% residential buildings in peri-urban and rural areas	Maintenance of installed solar energy appliances and energy systems

Energy Efficiency

Conducting a cool roofing drive/ exercise for flat roof houses[100]

Phase 1 2025–2027	Phase 2 2028–2031	Phase 3 2032–2035
Suggested Climate Smart Activities		
All public and government buildings are to be retrofitted with cool roofs	1. Flat roof residential buildings and commercial buildings to be provided with cool roofing as part of a city-wide initiative 2. Cool roofing of all pakka houses in households within the planning area	Non-flat roof structures, such as those in low-income settlements to be retrofitted with modular cool roofs made of organic materials[101]

Estimated Cost

Cost of white lime application: ~₹0.50 per sq. ft.
or
Cost of reflective paint coating application = ~₹20 to ~₹40 per sq. ft.

Energy efficient fixtures

Phase 1 2025–2027	Phase 2 2028–2031	Phase 3 2032–2035
Suggested Climate Smart Activities		
1. Conducting energy audits for all the public buildings to assess their energy efficiency potential 2. Increasing the penetration of energy-efficient appliances at the administrative, commercial, and household level	1. Adoption of Energy Conservation Building Code (ECBC) compliance mechanism by local government/ ULBs to improve building energy efficiency[102]	Expansion of Phase 1 & Phase 2 activities

100. Lime wash and reflective painting of roofs of residential buildings to control space temperatures during summer months.
101. https://www.downtoearth.org.in/news/urbanisation/why-innovative-cool-roofing-is-becoming-popular-among-ahmedabad-s-urban-poor-82523
102. Successful case examples of implementation of ECBC mechanism at city level can replicated to other cities as well. lhttps://niua.in/csc/assets/pdf/RepositoryData/Energy_&_Green_Building/Greening_Indian_Cities_through_efficient_buildings.pdf

3. Replacing all energy fixtures with energy efficient fixtures in all government buildings
4. Residents must also be encouraged to upgrade other household appliances energy efficient appliances (rated 4-5 stars by BEE)

2. Capacity building programs for participants that include government officials from town & country planning, municipal bodies, electricity utilities and other stakeholders (builders, developers) for effective implementation of ECBC mechanism
3. Residents must also be encouraged to upgrade other household appliances energy efficient appliances (rated 4-5 stars by BEE)

Existing Schemes and Programmes

- Atal Jyoti Yojana and MNRE Solar Street Light Programme provide subsidies for the installation of solar street lights with 12 Watt LEDs and a 3-day battery backup[103].
- The Uttar Pradesh Solar Energy Policy, 2022 provides:
  - Subsidy on solar installations in the residential sector: From ₹15,000/kW to a maximum limit of ₹30,000/- per consumer over and above the Central Financial Assistance by MNRE.
  - Provision for solar installations in institutions in Renewable Energy Service Company (RESCO) mode by themselves or in consultation with UPNEDA with consultancy fee of 3% cost of the plant.
- Central Financial Assistance (CFA) by MNRE through Grid Connected Solar Rooftop Programme
  - CFA up to 40% will be given for RTS systems up to 3 kW capacity. For rooftop solar system (RTS) of capacity above 3 kW and up to 10 kW, the CFA of 40% would be applicable only for the first 3 kW capacity and for capacity above 3 kW (up to 10 kW) the CFA would be limited to 20%.
  - For Group Housing Societies/Residential Welfare Associations (GHS/RWA) CFA will be limited to 20% for installation of RTS plants for supply of power to common facilities. The capacity eligible for CFA for GHS/RWA will be limited to 10 kWp per house and total not more than 500 kWp.
- Budget 2024-25: PM-Surya Ghar: Muft Bijli Yojana aims to achieve 300 units of free electricity per month to 1 crore households through rooftop solarisation[101].
- AMRUT initiatives:[105]
  - Energy audit of water pumps and replacement of inefficient pumps.
  - Replacement of conventional lights with LEDs.
- The Pradhan Mantri Awas Yojana (PMAY) and the Eco-Niwas Samhita schemes can boost the green residential buildings initiatives at city level[106].

103. https://mohua.gov.in/upload/uploadfiles/files/NMSH-2021-30.pdf
104. https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2010130
105. https://mohua.gov.in/upload/uploadfiles/files/NMSH-2021-30.pdf
106. https://mohua.gov.in/upload/uploadfiles/files/NMSH-2021-30.pdf

- Green Building Incentives in India:
  - The Green Rating for Integrated Habitat Assessment (GRIHA) initiatives by government of India can help promote green buildings/sustainable construction practices[107].
  - Leadership in Energy and Environmental Design (LEED) certification is a widely recognized global certification for green building projects. Green Business Certification Inc. (GBCI) is India's only body responsible for providing LEED certification.
  - Tax benefits to developers of LEED-certified buildings through the Income Tax Act.
  - Low-interest loans through the Indian Renewable Energy Development Agency (IREDA) for building projects with green certifications.

Key Departments

- Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA)
- Uttar Pradesh Power Corporation Limited (UPPCL)
- Rural Development Department
- Department of Agriculture
- Education Department

107. https://mohua.gov.in/upload/uploadfiles/files/Energy_Efficiency.pdf

6. Industry and Livelihoods

- As a tourism center, Ayodhya has potential to significantly develop eco-friendly tourism initiatives within the city, and its vicinity. Moreover, the development of eco-tourism in Ayodhya can generate employment opportunities for the local community, promote the preservation of traditional crafts, and support sustainable livelihoods. A few initiatives have been identified that can be built upon to cultivate climate-positive tourism avenues in the region.
- Agri-allied sectors play a crucial role in strengthening the rural economy. These activities help diversify income streams, improve resilience against crop failures, and enhance employment opportunities.

Exploring Ecotourism Initiatives within and around Ayodhya City

Development of a Riverfront Ecological Park

Development of an ecological park along the Saryu River, incorporating native flora and fauna, walking trails, meditation areas, and interpretive centers focused on the river's ecological significance and Ayodhya's spiritual connection to it.

- Arogya Van (For suggested species, significance, meditation areas, refer the section 'Development of Green Spaces in Ayodhya' in Annexure 6).
- Walking trails (Native tree species, bird watching, signages for information for generating awareness/interest).
- Opportunities for job creation: Zero waste generation products marketed (SHG engagement); Annual 'haat' for regional craft products and native medicinal plants; sale of compost).

Sustainable Accommodations

Development of eco-friendly accommodations for pilgrims, using sustainable materials, renewable energy sources, and waste management systems. Incorporate green spaces and water conservation practices.

- Initiating a '*Harit Dharamshala*' initiative incorporating traditional building materials and designs to minimise energy use, promote water conservation.

Community-Based Rural Tourism

Along the lines of 'Homestay Development in Ayodhya', a similar initiative can be developed for promotion of homestays and village tours in selected gram panchayats within the Ayodhya Planning Area with a focus on crafts, agricultural practices, and wetland ecosystems. Promote workshops on traditional ecological knowledge (TEK) including farming, forgery, culinary practices, etc.

- Identify clusters of 5-7 villages to create homestays across Ayodhya by involving stakeholders from State Government, Panchayati Raj Institutions, NGOs, rural communities and local businesses.
- Community trainings through workshops: Organising 'Skill and Entrepreneurship Development Training Programmes' to enhance employability for stakeholders associated with the tourism sector dedicated to various themes like food processing centres, heritage tourism units, rural homestays, farm stay, cultural centres to sensitise, upgrade and build capacities of all tourist service providers, especially people residing near tourism sites and destinations.
- Experiential tourism: This can include learning about local heritage including traditional culinary.

Cycling and E-vehicle Tours

Introduce cycling and e-vehicle tours around the city and nearby natural attractions, reducing the reliance on fossil fuels for transportation while offering a healthy and immersive way to explore Ayodhya. The proposed NMT corridors can be leveraged for this activity.

- » Key cultural historical locations.
- » Ecological tours: Creating a circuit of suitable wetlands (restored as part of the suggested climate–smart activities in the city).
- » Climate-smart interventions showcase: Organic waste management park; Kunds for water rejuvenations, etc.

Agri-allied Livelihoods

Effective Utilisation of Agri-waste

- Creating value chains routing sugarcane waste in bioethanol production, which would include converting bagasse into bioethanol through fermentation processes. Bioethanol can be used as a renewable fuel for vehicles or as a blend with petrol.
- Biogas production: Using sugarcane waste, including press mud and bagasse, in anaerobic digesters to produce biogas.
- Utilising bagasse as a raw material in paper manufacturing. Existing SHGs can be involved in utilising this raw material in production of diaries, posters, etc.These items can be sold as novelty items to tourists.
- Production of biodegradable packaging materials: Using bagasse to produce biodegradable packaging materials like plates, cups, and trays as eco-friendly alternatives to plastic products.

Promotion of RE-powered Cold Storages and Food Processing Units

Measures to reduce post-harvest losses and creating alternative value chains for agricultural produce:

- » Decarbonising seasonal jaggery processing units[108] through use of energy efficient technologies and use of decentralised renewable energy solutions.
- » Setting up of net-zero jaggery processing units.

108. Jaggery has been notified as part of 'One District One Product' campaign for Ayodhya by the Department of MSME and Export Promotion, Uttar Pradesh

Sustainable Management of Livestock Waste

- Diverting livestock waste as input feed for bio-CNG generation plant in Ayodhya (Refer 'Bio-energy Generation in Ayodhya' given in Annexure 6 or community-level biogas plants).

Key Departments

- Tourism Department
- Ayodhya Development Authority
- Ayodhya Nagar Nigam
- Department of Agriculture
- Uttar Pradesh New and Renewable Energy Development Agency (UPNEDA)

07

Monitoring and Evaluation of City Climate Action Plan

Monitoring and Evaluation (M&E) is essential for Ayodhya City Climate Action Plan (CCAP), ensuring effective implementation, tracking progress, and assessing impacts on resilience and sustainability. In a shifting climate landscape, a robust M&E framework provides structure to evaluate success, address new challenges, and guide data-driven improvements. This section outlines measurable indicators to monitor outcomes, optimise resources, and align actions with Ayodhya's climate resilience goals, supporting continuous, community-focused adaptation. This section also identifies key stakeholders and institutions to be engaged in the monitoring and evaluation process.

Suggested Indicators

The following table provides indicators across key themes of the CCAP. The indicators provided as part of this plan are not exhaustive, and should be updated periodically to better reflect the outcomes achieved as part of the implementation of climate action suggestions. Relevant departments and ULB offices as identified in the recommendations section will provide data reports for relevant indicators to the Monitoring Committee.

Indicators can be against an established baseline (year when the implementation starts) and then progress of the implementation can be measured annually or bi-annually as per decision of the Monitoring Committee.

Sustainable Management of Waste

Proposed Interventions	Broad Suggested Indicators	Broad Anticipated Outcomes
Ensure 100% segregation and collection of waste at source 1. 100% households covered under door-to-door segregated waste collection 2. 100% of commercial establishments to segregate waste at source 3. Installation of triple waste bins at strategic locations 4. Procurement of EVs for waste collection 5. Setting up of e-waste collection centres	Percentage of households (urban+rural) from where segregated waste is collected	**Efficient waste collection and processing, increased recycling, and enhanced sanitation services contribute to cleaner and healthier communities, and reduce emissions by preventing waste to reach landfills**
	Percentage of commercial and institutional/administrative establishments from where segregated waste is collected	
	Number of EVs in use for waste collection	
	Percentage of collected dry waste recycled/processed (urban+rural)	
	Percentage of collected wet waste processed (urban+rural)	
	Number of waste collection bins installed at strategic locations	
	Number of operational e-waste collection points established	
	Percentage of localities covered under monthly collection of e-waste	
Management of Organic Waste 1. Setting up of waste management park 2. Setting up of composting drums at temples 3. Setting up of composting unit for organic temple waste	Number of temples using decentralised composting drums	
	Percentage of organic waste composted that is generated from temples	
	Number and installed capacity of centralised temple waste bio-management facilities operational (TPD)	
	Capacity of waste management park (TPD)	
Management of C&D waste	Number of C&D collection and transfer stations	
	Total installed capacity of C&D waste management plants (TPD)	

Transport and Green Mobility

Proposed Interventions	Broad Suggested Indicators	Broad Anticipated Outcomes
Introducing electric public vehicle (inter and intra city) 1. Introduction of EV buses in the public transport fleet	Number of EV buses procured and operational	**Increased EV adoption, enhanced charging infrastructure and multiple pedestrian friendly zones that support low carbon mobility** 
Enhancing infrastructure for private EVs 1. Setting up dedicated parking spaces for EVs 2. Setting up a network of EV charging stations	Number of public parking spots available for EVs	
	Number of parking lots with reserved areas for EVs	
	Total number of public EV charging stations in the planning area	
Planning for Non-motorised Transport Infrastructure 1. Enhanced coverage of NMT corridors across the city 2. Promote public bicycle sharing hire spots	Length of NMT corridor operational	
	Number of bicycle hiring kiosks operational	

Green Spaces and Urban Cooling

Proposed Interventions	Broad Suggested Indicators	Broad Anticipated Outcomes
Dedicated green spaces in the city 1. Restoration of public parks 2. Creation of Green Steward teams for community-led plantation drives 3. Increasing survival rates of plantations 4. Installation of vertical gardens	Number of parks restored	**Expanded green cover, improved biodiversity conservation, and increased urban green spaces for environmental and social benefits**
	Percentage increase in tree cover in the planning area since baseline year	
	Number of saplings planted (includes plantations along ghats, parks, kunds, and other open spaces)	
	Number of plantation drives conducted (through community engagement)	
	Average plantation survival rate achieved	

Proposed Interventions	Broad Suggested Indicators	Broad Anticipated Outcomes
Cool pavements and carriageways 1. Plantation of shade trees along arterial and sub arterial roads, and NMT corridors 2. Construction of cool pavements	Number of saplings planted (includes plantations along roads, along tourist circuits)	
	Length of pathways and footpaths with reflective paving	
Development of People's Biodiversity Register (PBR)	Number of villages in the planning area with updated PBRs	
	Number of biodiversity awareness sessions organised for the community	

Water and Wastewater

Proposed Interventions	Broad Suggested Indicators	Broad Anticipated Outcomes
Management of water bodies 1. Restoration of wetlands 2. Restoration and softscaping of kunds	Number of wetlands rejuvenated/restored	
	Number of kunds restored and softscaping carried out	
Groundwater management 1. Construction of rainwater harvesting structures (RwH) in public buildings in the city 2. Construction of RwH in PRI buildings 3. RwH in all suitable tourist accommodations	Number of public buildings (government offices, government schools, institutes, etc.) having functional rainwater harvesting mechanism	**Improved water access, rejuvenation of ground water and water bodies to support sustainable water management and enhance resilience**
	Number of PRI buildings having functional rainwater harvesting mechanism	
	Percentage of public/PRI buildings covered with RwH mechanism	
	Number of hotels/lodges/guest houses with RwH structures	
	Number of new buildings with RwH structures	

Wastewater management 1. Enhancing storm water and wastewater infrastructure	Percentage (length) of roads with proper storm water drain coverage	
	Number of silt traps installed at outfall point of drains	
	Number of trench grates installed along the curb of the road in residential and civil line area	
	Number of households connected to sewage system	
	Percentage of households connected to drainage/sewage network	
	Capacity of installed, operational, and maintained STPs	
	Number of DEWATS installed in the villages within the planning area	

Clean Energy

Proposed Interventions	Broad Suggested Indicators	Broad Anticipated Outcomes
1. Increasing the share of RE installations 2. Upgradation of street lights to solar LED street lights and solar LED high mast 3. Promotion of DRE in peri-urban and rural areas 4. Conducting cool-roof drives in the planning area	Number of public (government offices, public schools, institution) and PRI buildings with solar rooftop/ bio solar rooftop installed	**Increased renewable energy use, improved energy efficiency, and greater access to clean cooking and modern energy infrastructure**
	Percentage of public buildings with solar rooftop/ bio solar rooftop installation	
	Total solar rooftop capacity installed (residential, commercial, institutional, government) (MW)	
	Number of solar water pumps in use	
	Number of solar LED street lights and solar LED high masts street lights installed	
	Number of biogas plants operational	
	Total biogas capacity installed (TPD)	
	Number of public buildings retrofitted with cool roofs/ Percentage of public buildings with cool roof material application	

Tourism

Proposed Interventions	Broad Suggested Indicators	Broad Anticipated Outcomes
Incorporate sustainable waste management awareness with tourism activities 1. Workshops organised for capacity building of hospitality professionals on best practices for waste management and segregation 2. Hotels and other tourist accommodations to have signage on waste disposal 3. Community engagement for nudging social change 4. Sustainable accommodations	Number. of capacity building workshops organised for hospitality professionals (waste, management)	**Increased sustainability practices in hospitality, including water management, waste management and energy efficiency, enhance eco-friendly tourism experience**s
	Number of '*Swacchta Saarthis*' deployed at key locations	
	Number of hotels/lodges/rest houses with IEC material on waste segregation and disposal displayed	
	Number of solar water kiosks installed and operational at public places	
	Percentage of hotels/lodges/guest houses with sustainable infrastructure (ECBC compliant, Harit Dharmshala, etc.)	

Monitoring Committee

The progress can be monitored at the city level through the formation of a Monitoring Committee which has nodal representatives from relevant departments as identified in the recommendations sections, and which works in sync with the District Environment Committee, Ayodhya Nagar Nigam, ADA to ensure implementation of the actions and timely monitoring of the progress.

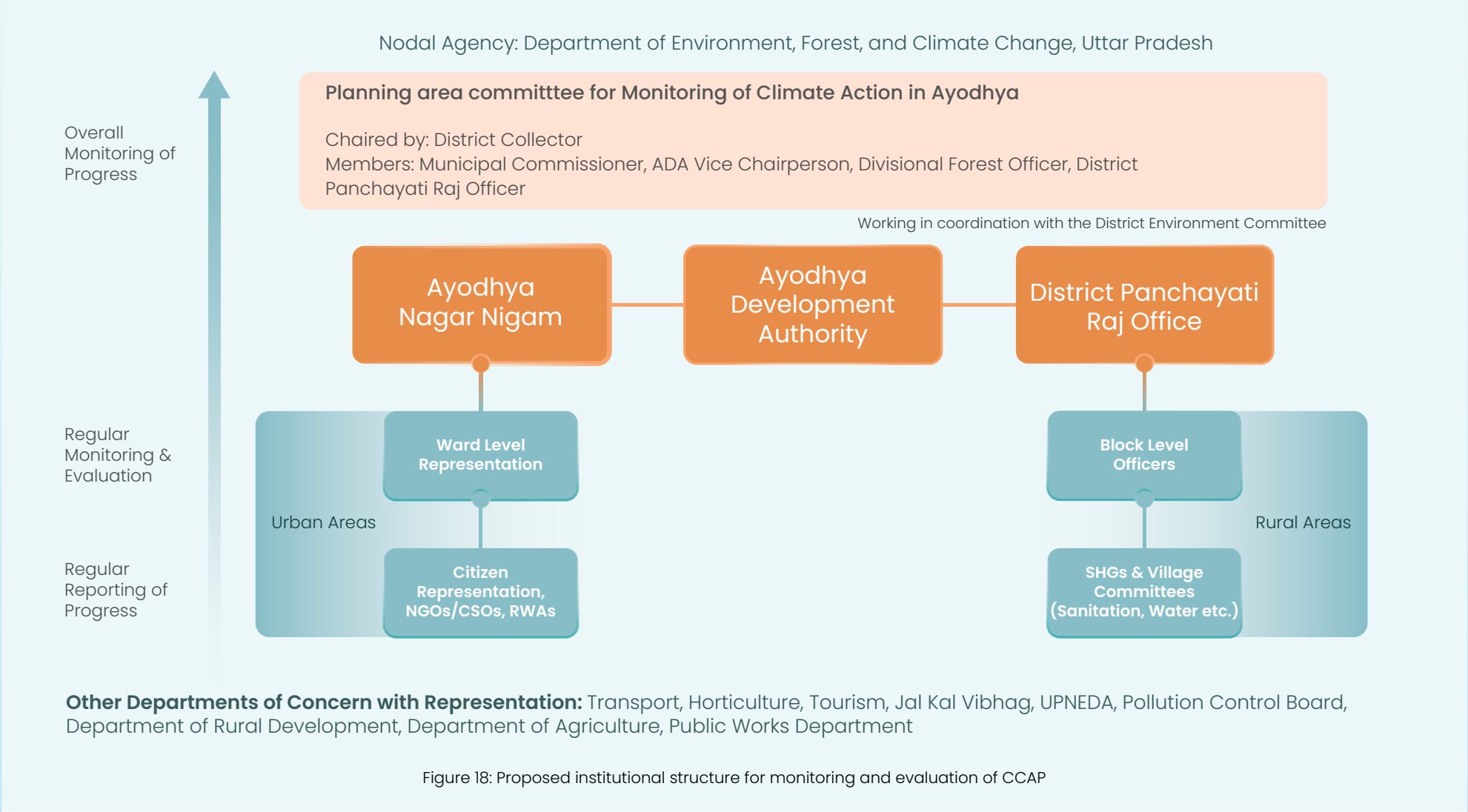


Figure 18: Proposed institutional structure for monitoring and evaluation of CCAP

08

Way Forward

The long-term desired outcomes from the Ayodhya City Climate Action Plan include building a resilient, sustainable urban environment that minimises its carbon footprint while enhancing the quality of life for its residents. Key goals include a significant reduction in greenhouse gas emissions through improved energy efficiency, increased use of renewable energy, and sustainable urban mobility solutions. The plan aims to create extensive green spaces, protect local biodiversity, and improve air and water quality, contributing to climate mitigation and adaptation. Additionally, the plan seeks to engage local communities in sustainable practices, foster economic growth through green jobs, and ensure that Ayodhya becomes a model for climate-resilient urban development.

The Uttar Pradesh State Action Plan on Climate Change 2.0 (SAPCC 2.0) has laid out actionable points for the Ayodhya Planning Area which can be beneficial in providing a strategic direction for these long term outcomes. These include development of a Comprehensive Mobility Plan and the preparation of urban level spatial maps for mapping of low lying areas.

In addition, Ayodhya would be contributing to the state's vision and targets on climate action as envisioned in the UP SAPCC 2.0 by implementing the proposed interventions. This would, in turn add to the country's endeavours to address climate change, contribute to the NDC goals as well as help in the achievement of Sustainable Development Goals by 2030.

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Annexures

Annexure 1: Additional Tables and Figures

Table 1 : Land Use Statistics for Ayodhya Development Authority Area (Part A), 2020, Ha

Land Use	Existing land use area (Ha)
Residential	1466.00
Commercial	124.46
Industrial	143.09
Transportation	580.98
Recreational	75.90
Public utility area	163.31
Public and Semi -Public	470.30
Other mix use	137.19
Total (A)	**3,092.92**
Agricultural	9,324.30
Wetlands	950.29
Other (B)	**10,274.59**
A+B	13,367.51

Source: Ayodhya Master Plan

Table 2: Year-on-year category wise vehicle growth

Year	Heavy Vehicle	Light Vehicle	Medium Vehicle	Three Wheeler	Two Wheeler	Other
2019	296	4,948	77	1,370	41,906	65
2020	79	4,026	52	643	27,983	21
2021	171	4,365	57	1,311	29,565	19
2022	339	4,575	63	3,173	28,968	11
2023	474	4,990	72	4,192	33,415	59

Source: Ministry of Road Transport and Highways, 2023

Annexure 2: Methodology for Analysing Observed and Projected Climate Variability

Rainfall variability has been analysed for the **Southwest monsoon (June to September) and Northeast monsoon (October to December)** seasons. Additionally, the precipitation extremes, such as the number of rainy days, Consecutive Dry Days (CDD), and heavy rainfall amounts (RX1DAY, RX5DAY), have been analysed.

Rainy day:

A rainy day, according to the India Meteorological Department, is defined as any day on which rainfall is more than 2.5 mm.

Consecutive Dry Days (CDD):

Maximum number of consecutive dry days per time period with daily precipitation amount of less than 1 mm.

RX1DAY:

Highest 1-Day precipitation amount.

RX5DAY:

Highest consecutive 5-Day precipitation amount.

Temperature has been analysed for the summer season (March to May) and the winter season (December to February). The temperature extremes such as Warm days (%), Cold days (%), Heat wave duration and Frequency have been analysed.

Warm days:

Percentage of days when maximum temperature is greater than the 90th percentile.

Cold days:

Percentage of days when maximum temperature is less than the 10th percentile.

HWDI:

The number of heat wave periods not less than 5 days.

HWFI:

Maximum number of consecutive days per year when the daily maximum temperature is above the 90th percentile.

The historical climate information and projections in climate for a future period have been analysed in this chapter using global climate models. The simulations of precipitation and temperature have been used for 1986 to 2005 (historical period) while projections have been considered over four different epochs 2021-2040 (2030s), 2041-2060 (2050s), 2061-2080 (2070s) and 2081-2100 (2090s) under medium (RCP4.5) and high (RCP8.5) emission scenarios.

Annexure 3: Methodology for Developing Sector-specific Recommendations

1

City Profiling

Mapping baseline information across key sectors: Demography, Economy, Industry, Land-use, Agriculture, Water and Sanitation, Waste management, Transport, and Energy.

2

Needs and Potential

Understanding key issues from a climate lens through stakeholder consultations, and a sample citizen perception survey. Mapping gaps existing development plans.

3

Baseline Scenario Mapping (Climate-relevant activities)

Sectoral mapping of key installed/constructed and in-pipeline projects in climate-aligned sectors such as Renewable Energy, Waste Management Infrastructure, Green Spaces, Sanitation, Mobility, etc.

4

Suggested Sectoral Interventions

- With environment and climate lens, mapping potential interventions for crucial sectors from both climate change mitigation and adaptation perspectives including:
- Renewable Energy | Green Mobility (Proposed Corridors and Circuits | Blue-Green Spaces | Sanitation | Waste Management
- Identification of strategic nodes, zones and stretches to develop interventions
- Developing draft specifications (both with qualitative and quantitative details, wherever possible) for suggested interventions.

5

Stakeholder Consultation and Ground Truthing

- Primary data collection: Data collection templates shared with relevant departments
- Departmental visits and stakeholder consultations: Plugging in data/knowledge gaps to check the technical and spatial feasibility of draft interventions from authorities
- Ground truthing: Ground-level checks and corrections in locations, extent and condition of current infrastructure (MRF centers, waste dumping sites, parks/open spaces etc.) and natural features (wetlands, ponds, river, etc.).

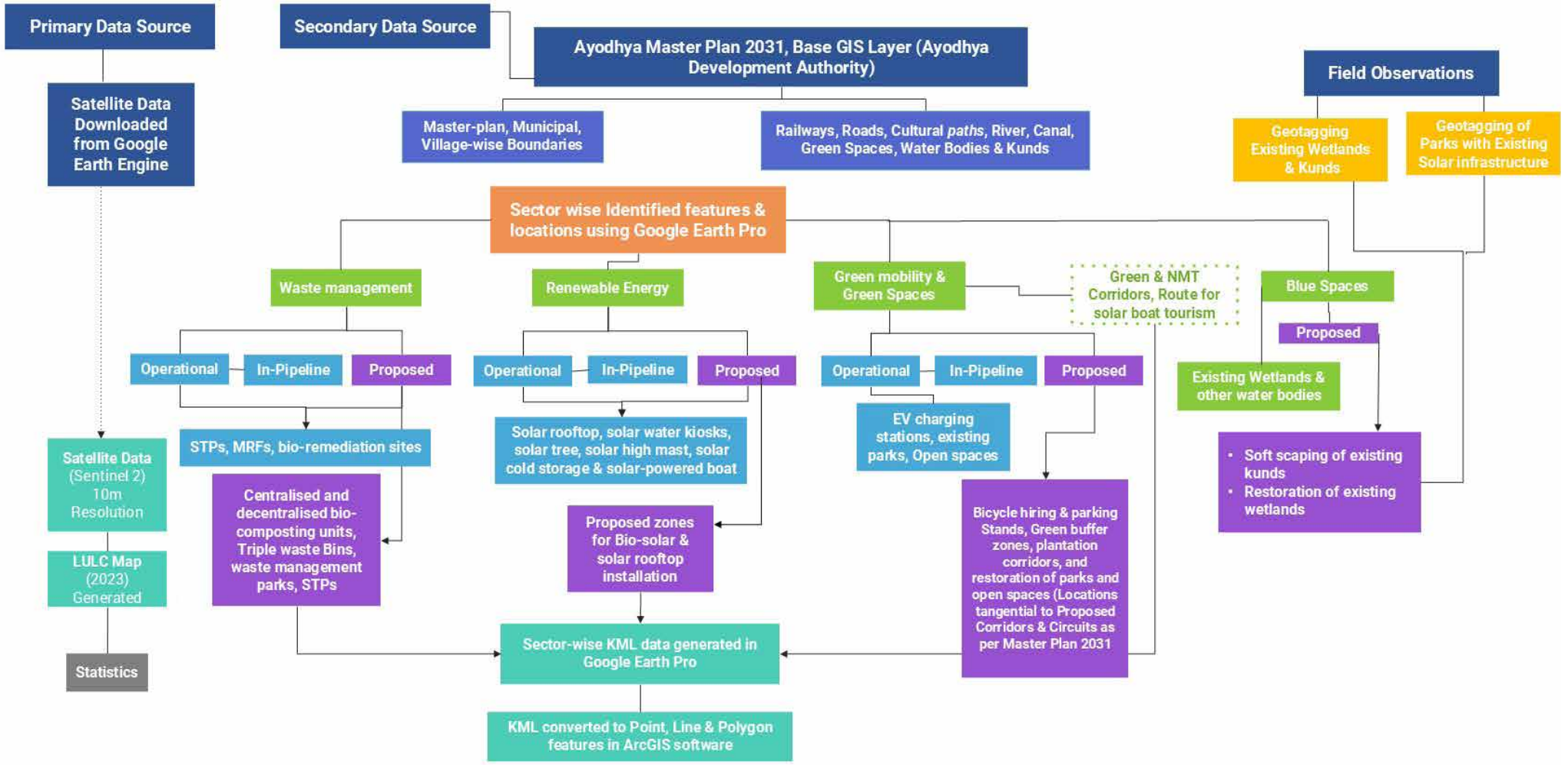
6

Recommendations for Ayodhya City Climate Action Plan

- Developing the sectoral interventions based on field visit insights and information received considering: 1. Spatial and land feasibility (land use, ownership)
- Convergence of suggested intervention with the Ayodhya Master Plan 2031 (for easy dovetailing with Master Plan proposals from climate action lens)
- Phasing and Cost Estimation: Activities under each suggested intervention were divided across three phases, and estimated unit costs for interventions provided (wherever possible).

Phase 1: 2025 - 2027 ➤ ***Phase 2: 2028-2031*** ➤ ***Phase 3: 2032 - 2035***

Annexure 4: Methodology for Spatial Mapping of Proposed Climate Action Activities for Ayodhya



Note:

Existing and in-pipeline climate-smart activities identified through primary and secondary sources, including information received through various line departments Identification of land use/land classification and land ownership as per Ayodhya Master Plan 2031. Identified wetlands mapped as per information provided by Forest Department, Ayodhya

Annexure 5: Notes on Methodology for GHG Emission Estimates

Waste

Domestic Wastewater

Activities in the domestic wastewater sector contribute to greenhouse gas (GHG) emissions primarily through the decomposition of organic matter. In the domestic wastewater sector, organic matter undergoes anaerobic decomposition during treatment processes, producing methane and other GHGs. Furthermore, the release of carbon dioxide during the breakdown of organic matter in both sectors further exacerbates GHG emissions. For the Ayodhya planning area, total emissions from domestic wastewater were estimated for both urban areas and rural areas, respectively. Total emissions from this sector amounted to ~16,145.37 tCO_2e, which is 77% of the emissions in this sector. Rural and Urban population for baseline year 2022 was approximated using CAGR on 2011 Census data for Ayodhya Planning Area (Urban+Rural).

Solid Waste

In the solid waste sector, organic waste undergoes anaerobic decomposition in landfills. When solid waste is deposited in landfills or dumps sites without oxygen, methanogenic bacteria decompose its organic matter, resulting in methane (CH4) emissions. This organic material decomposes gradually, and the methane emissions from a given amount of disposed solid waste persist for several decades. Solid Waste estimates are only provided for the municipal area, where municipal solid waste includes waste from residential, commercial, and institutional sources. Emissions from solid waste in Ayodhya municipal area in 2022 were estimated to be ~4,705 tCO_2e, which is 23% of total emissions of the waste sector {domestic wastewater (rural), domestic wastewater (urban), and solid waste}.

Industrial Wastewater

Emissions from the industrial wastewater category predominantly stem from the discharge of effluents containing various pollutants into water bodies. Industrial processes generate wastewater rich in organic compounds and other contaminants. When untreated or inadequately treated wastewater is released into water systems, microbial action on organic matter produces methane and other greenhouse gases. Furthermore, the disposal of sludge generated during wastewater treatment can result in anaerobic decomposition, releasing methane.

Data for industrial wastewater generation for key category industries within the planning area was obtained from the Regional Pollution Control Board Office, Ayodhya[109]. Key industries included one sugar mill, one bottling unit and one pulp & paper manufacturing unit. The total emission from this wastewater generation due to activities in this sector was ~4,95,822 tCO_2e.

109. It was informed from the department that reported data for production and wastewater emission was an average of three years (2021, 2022, 2023). Data for baseline year 2022 was considered as such and not adjusted.

Agriculture

Rice Cultivation

Rice fields are a significant source of methane emissions in the agriculture sector due to anaerobic decomposition of organic materials in flooded fields. Based on the discussions with stakeholders from the District Agricultural Department in Ayodhya, it came out that the water regime followed for rice cultivation in the area is continuous flooding . At the district level, rice cultivation for the year 2022 (Kharif season) was ~99,090 ha. Data on rice cultivation area in the planning area for Ayodhya is not available, hence, the area under rice cultivation as a proportion of total agricultural area at the district level was used to calculate area under rice within the planning area for 2022[110]. The emissions from rice cultivation in that year amounted to ~15,516.46 tCO_2e.

As per the proposed land use for 2031 as per Master Plan for Ayodhya, area under agriculture will decline by ~70 percent, and is expected to be 2,812.04 ha. Hence, given a direct proportional decrease in area under rice cultivation, emissions from continuous flooded water regime for cultivation of rice will also decline by ~70 percent.

Crop Residue Burning

Biomass burning in cropland was considered as a key category in emission estimates, as both sugarcane and paddy are key crops cultivated in the region[111]. Other crops included are wheat and mustard. While agricultural area might be on the decline in the planning region of the city (see section above on "Rice Cultivation"), a static emission estimate is considered for 2022. The total emissions estimated from biomass burning in crop land amounted to 1903.23 tCO_2e.

Livestock

Livestock population for the planning area was derived from the 20th livestock census (2019) and the 19th livestock census (2012)[112]. For the base year of 2022, livestock numbers were derived using increment ratio, as given in Table 6.

Table 6: Estimated Total Livestock Population, Ayodhya Planning Area, 2022

Cattle	Buffalo	Sheep	Goat	Pig
32,654	30,265	341	13,380	356

Total emissions from enteric fermentation were ~77,433 tCO_2e while from manure management were ~7,818 tCO_2e. Discussion with stakeholders revealed that while an updated district level livestock census has not been undertaken, livestock numbers might be on the decline in the urban area.

110. Land use under the agriculture category was ~9,324 ha as per the Ayodhya Master Plan 2031
111. Estimated production of paddy was 42,11,325 quintals, and sugarcane was 3,77,37,850 quintals in 2022 as per data received from the office of Agricultural Department, Ayodhya.
112. For 2019, livestock numbers for villages and wards in the planning area were available. However, only district level livestock numbers were available for 2012, and livestock numbers for planning area were taken as a proportion of 2019 values.

Annexure 6: Detailed Recommendations

1. Draft Note: Strengthening Urban Greening Initiatives in Ayodhya

Background

The following document recommends certain measures to enhance urban greening measures in Ayodhya keeping in view the following:

- Site identification: Ayodhya Development Authority and Nagar Nigam Ayodhya have identified 80 sites for plantation[113], which includes public parks, chowks (road intersections), and a wetland.
- Total area under consideration is ~14 ha (excluding Samda wetland), and sites identified as unfit for plantation activities.[114]
- Additional locations that can be brought under consideration include additional riverfronts (Naya Ghat), additional wetlands, kunds, and curb walks/footpaths.

Further, this note lists out key prerequisites for undertaking greening activities, such as site suitability studies, species selection, and stakeholder engagement. Following this, various ideas / innovative solutions are discussed for urban greening with focus on involvement of the community. The next section introduces innovative plantation techniques, tailored for various types of urban spaces—from large open areas to small roadside curbs.
Subsequent sections cover different approaches for large and small areas, riverfronts, and concretized regions, with a focus on enhancing soil health, water management, and biodiversity. Further, the document presents case studies of successful greening initiatives from other cities, which serve as models for replication in Ayodhya.

Pre-requisites

To undertake greening initiatives, the following action points should be considered and scoped out:

- Site suitability studies to develop an understanding about the soil characteristics of the site and the plantation potential.
- Identification of suitable species (indigenous, endangered, medicinal)[115]. Information regarding the same can be obtained from the Forest Department or the Botany departments of regional universities/colleges.
- Identification of agencies and developers.
- Identification of capacity building and monitoring partners.
- Designing media and community engagement campaigns.
- Identification of sources of finance.
- Documentation of all public and community parks in the city to ascertain tree-coverage.

113. Not including sites identified as 'unprotected'
114. Calculated based on location-wise area shared in Greening Ayodhya slide deck
115. A comprehensive list of tree species can be found at https://www.researchgate.net/profile/Omesh-Bajpai/publication/308747653_Trees_of_Uttar_Pradesh_Part_1/links/57ee18a208ae886b897280a0/Trees-of-Uttar-Pradesh-Part-1.pdf

Ideas for Urban Greening

The following section describes potential plantations initiatives that can be recommended for a city like Ayodhya, such that community participation and citizen ownership can be increased in urban greening initiatives:

1. **Memorial Parks:** Personalisation of parks by providing citizens the opportunity to commemorate individuals or occasions. Citizens can have the option to plant a sapling of their choosing, and be made responsible for contributing in the upkeep of the plant throughout its life span, or for a certain hand-over period. Partnerships can also be explored with local temples for similar memorial plantations in residential colonies where space permits.

   Case Example: Nikol and Chandakheda, Ahmedabad.

2. **Bal Van:** Similar to memorial parks, a Bal Van nurtured where parents are encouraged to plant a sapling to commemorate the birth of a child. New parents will be gifted with saplings of indigenous evergreen trees as a celebration of the birth of their children and be encouraged to nurture the plants through their children's life.

3. **Arogya Van:** Dedicated area for growing plants with therapeutic properties, often used in traditional medicinal systems such as Ayurveda. The focus can be on growing indigenous varieties of herbs and plants, which can be used in wellness treatments such as pain relief and massages. Such a green space can also provide the parallel function of being a focus space for conducting activities related to Yoga, meditation, and other physical activities.

   Case Example: Arogya Van, Kevadia, Gujarat.

4. **Adopt-a-tree initiatives for government employees and citizens:** Adopt-a-tree campaign to be piloted in the city through engagement of government officials and citizen volunteers (Identified through civil society). For example, 5 officials from each district office and ULB office assigned to overlook the health and maintenance of 2 saplings each, as a pilot.

5. **Cultural Tree Planting Campaigns:** Leverage Ayodhya's cultural and religious significance by organising tree planting drives linked to important festivals or religious events. Sacred trees like Peepal, Banyan, and Neem can be planted in significant locations as part of community-wide celebrations. Citizen groups can be encouraged to take up curbside plantations in residential and commercial areas.

How to Enhance Survival Rates of Plantations:

To manage and ensure long term sustainability of planned plantations activities of varying nature, several key measures can be explored:

Tree guards:

- Innovative options can include bamboo-based tree guards, which is a sustainable, lightweight, cost effective and biodegradable material.
- Tree grates: For pavements with high foot traffic, a tree grate can prevent soil compaction, and prevent damage to tree roots.

De-concretisation of pavements:

- To ensure minimization of fresh water wastage to ensure groundwater recharge.
- Also aids in soil health improvement through well-draining soil that allows for root growth and deep percolation of water and oxygen.
- Incorporate green infrastructure elements such as permeable pavements in future developments in the city bioswales.

Soil and manure management:

- Testing the soil for nutrient deficiencies and pH imbalances and amend the soil as needed with organic matter, compost, and other soil conditioners to improve fertility and structure.
- Assessing soil nutrients is essential to reduce erosion, preserve soil fertility and maintain soil structure.
- Efficient water drainage is crucial for soil quality and plant health.
- Improved manure management helps reduce emissions.

Community participation:

- Partnering with Civil society organisations, youth clubs, RWAs, government departments to identify volunteers for citizen engagement programmes.
- Community-led monitoring of plantation health.

Tech integration for monitoring: Creation of monitoring database through geotagging of adopted saplings.

Nature of Plantations

Based on availability of land parcel, size, and location, varying plantation techniques can be employed. The following section provides information on potential plantation techniques that can be employed across sites based of feasibility and suitability:

Larger areas

- Function: Water seepage areas, enhance lung space, long-term sequestration potential.
- Plantation type: Dense plantations, cluster plantations.
- Plantation technique: Miyawaki: In this plantation 3-5 saplings are planted per square metre with a minimum of 20-50 different species, creating a multi-layered green forest with no maintenance required after a 2-3 year period.

Small areas (such as public parks and kunds)

- Function: Restoration of public parks, increasing coverage of native trees and varieties in parks, while balancing the need for open green spaces in cities. Soft-scaping of kunds to ensure plantation health, groundwater rejuvenation, and
- Plantation type: Cluster: Species based cluster, including flowering plant clusters.

Very small areas (Such as road intersections, corner parks[116])

- Function: Enhancing urban aesthetics
- Plantation types: Mixed plantation with avenue trees (such as Ashoka) and flowering plants and shrubs for nectar
- Plantation techniques: Reclamation of concretised areas, preparation of soil

Riverfront/Ghats:

- Function: Enhance lung space, provide shade, prevent soil erosion, aid biodiversity.
- Plantation type: Mixed plantation with shade trees, shrubs.
- Plantation techniques: For concretised areas, plantation of trees in tree grates to improve drainage enhances soil health. For de-concretised areas:
- For low lying ghat areas, native plant species that can withstand long periods of accumulated water, such as Sheesham
- Non fruiting species should be preferred to dissuade wildlife conflicts (such as monkey) in areas with higher human activities such as riverfronts

For paved/concretised regions such as pavements/roadside curbs :

- Function: Provide shade, keep concretised surfaces cool by mitigating heat island effect
- Plantation type: Roadside plantations with trees with umbrella or semi-umbrella crown are better suited (Eg. neem, mahua, mango, etc.)
- Plantation techniques: Reclamation of smaller concretised regions. Plantations in soil vaults, which are designed as pits with a drainage layer and structured soil layer for optimum use of limited surface area.

Riparian planting

- Function: Sediment filtration before surface runoff enters waterways. They act as buffers that regulate water flow and create corridors connecting habitats for native flora and fauna species
- Plantation type: Mixed plantation of with spaced lines of trees and shrubs
- Plantation techniques: Identifying plant species and soil conditions. Considering the Ayodhya planning area to be an upper bank area where flooding occurs partially every couple of years then use plant species that prefer dry conditions. Plant at 1m wide spacing.

Other plantation technique: Avenue planting[117]

- Function: Modulate the local microclimate and reduce air pollution, while also increasing soil permeability, allowing it to act like a sponge during flooding.
- Plantation type: Mixed plantation flowering plants and shrubs, planting local saplings
- Plantation techniques: Planting trees along streets for shade, arterial roads, water bodies, highway and aesthetics (it is mostly restricted to places where there is a minimum sidewalk width of 6.5 to 7.5 feet)

116. Refer to slide deck on Ayodhya Plantation sites
117. Successful example of Multi-Layer Avenue Plantation (MLAP) initiative by Telangana can be replicated at city level

Stakeholder Identification

- Government Departments (Ayodhya Development Authority, Forest Department, Department of Horticulture, Ayodhya Municipal Corporation)
- Local communities
- Civil Society Organizations
- Community-based Organisations
- Education Institutions
- Media

Benefits to Ayodhya

- Carbon Sequestration potential enhanced
- Potential of generating carbon credits and green credits through registered plantation activities
- Mitigating urban heat island effect
- Increased canopy cover
- Storm water regulation
- Increased water permeation and prevention of loss of top soil
- Other co-benefits, like improved air quality etc.

Successful Case Examples

A few examples of successful greening initiatives have been identified which can be replicated in Ayodhya:

Thane Greening Initiative:

The main objective of the initiative was to regenerate degraded forest land within the city limits and restrict soil erosion in the identified 50 ha hilly region. The Thane Municipal Corporation initiated a plantation drive in 2015 with the goal of planting 5 lakh trees. Over the course of four years, more than 6 lakh trees were successfully planted within the city limits.

Key Highlights:

- Free saplings distributed to the government departments, citizens, education institutions and NGOs and local leaders
- Geotagging of the planted trees
- Using technology for real-time monitoring of plantations
- Extensive campaigns with media and community engagement
- Adoption of soil and water conservation measures

Financing: The project was funded through the annual budget of the Thane Municipal Corporation

Urban Forestry Initiative: A Case Study Of Sabarmati Oxygen Park, Ahmedabad

Miyawaki plantation technique was taken up in Ahmedabad in 2019 for restoring the urban green environment, with a focus on native vegetation. The plantation park spans across 11,000 square meters and has dense forest in 5,500 square meter land, containing more than 25,000 trees of 45 varieties. The idea was to cover 65% of the space with dense forest, 15% with individual trees, shrubs, and grasses, and the remaining 20% with lawns, walkways, and utility areas.

Miyawaki design components that lead to success in Ahmedabad/ Key Highlights:

- Individual tree clusters
- Miyawaki forest clusters with 45 tree species in the periphery
- Selection of native tree species
- Natural contours towards water body helped in stormwater regulation
- Regular maintenance

2. Draft Considerations for Biogas Generation from MSW in Ayodhya

Overview

The Organic Fraction of municipal solid waste can be utilised to extract and generate Compressed Biogas (CBG). This innovative solution would not only tackle waste management challenges but would also simultaneously produce clean, renewable energy. By utilising various organic waste streams, the city of Ayodhya can transform what would typically be discarded, into valuable biogas.

Key Prerequisites for Economically Viable Biogas/Bio-CNG Plants: (if a developer is to be engaged)

An approach for biogas generation at the city level is proposed through the engagement of a technology provider and plant operator. The key prerequisites are :

Land

- To be provided by the Administration (Corporation/Development Authority)
- Ideal location would be an existing landfill site / waste management site

Quantity & Quality of waste

- A minimum viable quantity needs to be assured
- Segregated organic waste

Successful Case Studies

Indore Model Case Study:

Asia's largest organic waste to BioCNG plant was commissioned in Indore in December, 2021 with a nameplate production capacity of 15.3 tonnes per day (TPD) of BioCNG from 550 TPD of organic waste. Today, the plant is generating up to 19 TPD of BioCNG. The plant has been set up in partnership between the Indore Municipal Corporation (IMC) and a private developer.

Key benefits for the Indore Municipal Corporation:

- An efficient system is put in place to manage the organic waste of the city, rather than sending it to the landfill.
- Over 50% of the Bio CNG generated is available to IMC at a fixed rate and utilised as fuel for public buses.
- Additionally, emissions avoided are also used to avail carbon credits by the Municipal Corporation

Key highlights: Business Model (Incremental cash flow)

- A private developer (waste management company) was engaged to develop the project, with the engineering, construction and operations being done by a biofuels technology company
- Land (a previous landfill, then a composting site) in Devaguradiya was provided to the developer for the construction/operation of Bio-CNG Plants.
- IMC buys ~50% of Biogas produced at a fixed rate and uses it for corporation vehicles (e.g., fuel for 146 city buses; target to reach 400 buses by March 2023)
- Monthly charges of around Rs.60 paid by each household and around Rs.70-80 by commercial establishments to IMC
- Businesses, offices, etc. pay Rs 3 per kg of waste collected from them

Other Case Studies

- Pune, Maharashtra: Bio-CNG plant, 300 TPD capacity[118]
- Bobbil, Andhra Pradesh: Biogas plant, 0.9 TPD capacity (generates 14 m3 of gas per day)
- Vijayawada, Andhra Pradesh: Biomethanation Plant, 16 TPD capacity

118. https://www.pmc.gov.in/en/biogas-initiative

About Ayodhya

Overview of Ayodhya

- Estimated Current population (Urban Ayodhya, 2022)[116]: 2,54,943
- Estimated Floating population 2031[117]: 3,50,000
- Ayodhya Municipal area: currently ~135 TPD of solid waste is generated and collected per day, over 50 percent of which is organic/wet waste.
- Other streams of waste include 15 TPD from temples and ghats, majority of which is organic
- Additionally, an estimated ~700 TPD of waste generated from livestock[118] in the planning area
- Additional waste streams identified include: agricultural waste and solid waste coming from the Ayodhya planning area i.e. villages, vegetable/fruit vendors, mandis etc.
- Based on the above an estimated 100-200 TPD of organic waste is generated in the Ayodhya planning area which can be used as an input for biogas generation

Key Stakeholders

Ayodhya Nagar Nigam, Ayodhya Development Authority, Technical Agency, Developer Gram Panchayats, Tourism Department, Temple trusts and committees

Key Action Points

- Accurate estimates are required for the segregated wet waste collected on a daily basis across waste streams
- Availability and identification of suitable land parcel for setting up a biogas generation unit (around 15-20 acres) - potentially bio-remediation sites (dumping yards)
- Mapping of waste collection and transfer stations across the planning area
- Promotion of segregated waste at-source and ensuring 100% waste collection:
  - » Developing a model for incentivising model for segregated waste at-source
  - » Adopt effective communication strategies
  - » Involving the community and local SHGs
  - » Strict Monitoring and Enforcement Mechanisms

Benefits for Ayodhya Nagar Nigam

- Management of wet waste in an optimal manner which will not only reduce emissions but also enhance sanitation conditions
- By product utilisation (Bio-CNG, organic compost)
- Avenues for revenue generation through leveraging carbon credits
- Reduction in cost of wet waste management and landfilling requirement
- Scalability of technology for management of future waste generation

116. Population of the year 2022 is a projected value; Census 2011 Population, Urban Ayodhya: 2, 21,118
117. Ayodhya Master Plan 2031. The population is based on the 133 sq. km area covered by Master Plan 2031. However, the Ayodhya Development Authority now includes 873 sq. km, which will increase the projected floating population. The current CCAP uses the population figure from the Master Plan 2031, Part A. The floating population may be revised as per the updated to the master plan
118. Assuming cows produce 10 kg dung/day, buffalos produce 15 kg dung/day, goats and sheep produce produce 150 g dung/day

Annexure 7: Planning Area Village List

1	Hajipur Singhpur	15	Ibrahim Pur Devli
2	Shivdaspur	16	Jagan Pur
3	Salar Pur	17	Jagdishpur
4	Aasifbaug Pathakpur	18	Kazipur
5	Baspur urf Jaisighpur	19	Khanpur Masaudha
6	Bhikhapur	20	Kot Sarwa
7	Biroli	21	Madhopur
8	Chirra Mohammadpur	22	Mohatrim Nagar
9	Fatehpur Saraiya	23	Mumtaj Nagar
10	Fatehpur Saraiya	24	Rai Pur
11	Firozpur	25	Sahanava/ Shanawa
12	Firozpur Uparhar	26	Samsuddinpur
13	Ghatam Pur	27	Shahnewazpur
14	Haripur Jalalabad-2	28	Toniya

NOTES

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