



Impact assessment of Miyawaki Plantation Project
CSR Initiative by Axis Bank Limited
February 2022 - March 2024

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Executive Summary

The Miyawaki plantation initiative implemented by Green Yatra Trust demonstrates a credible, scalable and nature-positive urban Nature-based Solution (NbS) aligned with the IUCN Global Standard for NbS and Results-Based Management (RBM) principles. The intervention establishes dense, multi-layered urban forests designed to enhance biodiversity, climate resilience and ecosystem services within public green spaces.

Strategic relevance and scalability

The intervention aligns with India's National Action Plan on Climate Change, urban greening priorities and the Kunming–Montreal Global Biodiversity Framework. It demonstrates a replicable urban afforestation model capable of informing municipal greening strategies, corporate climate investments and long-term NbS programming.

Survival performance

Out of 25,000 saplings planted, approximately 19,450 survived, resulting in a weighted **survival rate of ~77.8%** across sites. With a total investment of ₹1.5 crore (including plantation, two years of maintenance, monitoring and administration), the cost per surviving sapling was approximately ₹771, indicating strong financial efficiency when assessed against actual ecological outcomes rather than planting numbers alone. This reflects sound planning, effective execution and realistic value-for-money delivery in an urban context.

Biodiversity and ecosystem restoration

The intervention established a structurally complex, multi-layered forest system using **56 tree and shrub species**, demonstrating a clear net positive biodiversity outcome. Notably, four species (**~7%**) are **globally threatened** under the IUCN Red List, including two Endangered and two Vulnerable taxa, reflecting a deliberate shift beyond conventional afforestation towards managed ex-situ conservation alongside in-situ restoration. Species selection was predominantly native and regionally adapted to the Coastal Konkan–Western Ghats biogeographic zone, with a small, intentional inclusion of regionally non-native species for functional diversity and conservation value.

The documented return of **over 30 faunal species**, spanning **birds, reptiles and invertebrates** and representing **multiple trophic guilds**, confirms that the plantation intervention is supporting multi-taxa biodiversity recovery and improving ecosystem integrity, beyond vegetation establishment alone.

Climate mitigation and ecosystem services

Rapid early-stage biomass development was observed within approximately 2.5 years, with **canopy trees reaching average girths of ~30 cm** and **overall patch heights of ~10–12 m**, supporting strong early carbon accumulation and reinforcing the biological plausibility of long-term sequestration estimates. At approximately five years of age (mid-thinning stage), the combined **carbon sequestration potential across all sites is estimated at ~100,000 kg CO₂ per year**, indicating a sustained climate mitigation contribution.

Spatially, the intervention contributed an estimated **0.09% increase in green cover across three wards of Navi Mumbai**, demonstrating how compact, well-designed urban plantations can incrementally strengthen municipal green infrastructure within dense urban landscapes.

Air-quality co-benefits

A comparison of monthly AQI (2022–2024) at nearby **monitoring stations showed improvements in 9 out of 12 months**, with pronounced winter reductions. While not directly attributable to the plantation alone, these trends are consistent with the known co-benefits of increased urban green cover and are presented as indicative indirect gains.

Overall, the initiative demonstrates that well-designed urban Nature-based Solutions can deliver measurable biodiversity gains, climate resilience and strong value for money within public green spaces. With a documented return of 30+ faunal species across birds, reptiles and invertebrates, ~78% survival rate, early biomass growth (~30 cm girth and 10–12 m height within 2.5 years), a projected sequestration potential of ~100,000 kg CO₂ per year by mid-maturity, and a measurable 0.09% increase in ward-level green cover, the Miyawaki model offers a credible, scalable and governance-safe pathway. Taken together, these outcomes position the intervention as an evidence-based foundation for scaling high-impact urban Nature-based Solutions.

1. Background and Relevance

Project title	Miyawaki Tree Plantation, Navi Mumbai
Implementing partner	Green Yatra Trust
About the organization	Green Yatra is an environmental non-governmental organisation in India that undertakes initiatives aligned with the Sustainable Development Goals (SDGs). Its activities include tree plantation, urban biodiversity conservation, restoration of water bodies, development of sustainable environmental solutions, and programmes focused on research and awareness. The organisation applies a combination of traditional knowledge and contemporary technologies to support corporate entities in progressing toward their Net Zero objectives.
Project overview¹	Axis Bank, under its Corporate Social Responsibility (CSR) initiative, implemented a Miyawaki Tree Plantation project in Navi Mumbai in partnership with Green Yatra Trust. The project aimed to restore three degraded sites in the gardens by planting 25,000 native saplings using the Miyawaki afforestation technique. The details of plantation at each site are as follows: <ol style="list-style-type: none"> Jewel Garden (Nerul) 12,000 saplings Meenatai Thakare Udyan (Vashi) 5,000 saplings Naga Gana Patil Udyan (CBD Belapur) 8,000 saplings
Project period	February 2022 - March 2024 (~ 2 years)
Grant amount	INR 1,50,00,000
Project location/s	Navi Mumbai, Maharashtra
Problem statement	<p>Reports estimate that poor planning and urban management are expected to cost Indian cities between \$2.6 and \$13 billion annually². Urban ecosystems in Navi Mumbai are under mounting stress due to rapid urban growth, industrial expansion, and unplanned development especially in zones adjacent to industrial estates and mixed-use corridors like Maharashtra Industrial Development Corporation (MIDC). According to the Navi Mumbai Municipal Corporation (NMMC), the availability of green spaces in the city remains significantly below the ideal standards prescribed in national and international planning guidelines. Between 2001 and 2021, the region experienced rapid urban expansion that led to a substantial depletion of natural land resources: open land declined from 24.79% to 4.59%, while vegetation cover reduced from 16.36% to 12.10%³. This continuous conversion of open and green areas into built-up spaces has weakened essential ecological services such as biodiversity support, microclimate regulation, and groundwater recharge. According to the Urban and Regional Development Plans Formulation and Implementation (URDPFI) guidelines, urban planning should aim to provide approximately 10–12 square metres of green space per capita, or 1.2–1.4 hectares per 1,000 population, broadly aligned with WHO benchmarks, which recommend a minimum of 9 square metres per person and an ideal target of 50 square metres. The guidelines further stress the importance of equitable access, recommending that green spaces be located within 300–500 metres, corresponding to a 5–15 minute walking distance for urban residents⁴. However, ongoing urban densification, increasing vehicular traffic, and industrial proliferation in and around MIDC zones continue to demand green cover, and extrapolate the gap between existing conditions and recommended standards.</p> <p>Monitoring data shows that air quality in Navi Mumbai frequently exceeds WHO-recommended safe limits, with PM2.5 concentrations often in the ‘unhealthy’ range⁵. Furthermore, studies highlight</p>

¹ MoU between Axis Bank Limited and Green Yatra Trust signed on 3rd March 2022

² Mani, M. et al., 2018. South Asia’s Hotspots: The Impact of Temperature and Precipitation Changes on Living Standards, Washington.: World Bank Group

³ Ghute, S., Bhailume, S., Mali, S., & Sonawane, G. (2022). *Spatiotemporal dynamics of Navi Mumbai Municipal Corporation's urban expansion (2001–2021): A geospatial analysis*. International Journal of Food and Nutritional Sciences, 11(9), 4235.

⁴ National Institute of Urban Affairs. (n.d.). *Proportion of Green Cover – Training Manual (UPGCB2-GreenCover)*. Ministry of Housing and Urban Affairs, Government of India

⁵ Central Control Room for Air Quality Management

that land surface temperature (LST) in peri-urban areas of Navi Mumbai⁶, including Nerul and Belapur, is rising due to the loss of vegetative cover and increased concretization. Unregulated urban expansion, especially in industrial belts, has placed considerable stress on these ecosystems. This has led to the loss of native vegetation and biodiversity, reduced groundwater percolation, and increased surface temperatures due to diminished tree canopy and soil permeability. Pertaining to these issues, the deterioration in ecosystem services in urban-industrial transition zones of Navi Mumbai calls for urgent restoration efforts using nature-based solutions. Solutions include native species plantation while increasing water percolation through urban forest sponges. Globally, forest plantations are widely recognized as an effective solution to combat land degradation. One such approach of creating plantation forest is the Miyawaki method of afforestation and reforestation, which involves dense planting of native species. The Miyawaki plantation is a method to create dense, fast-growing native forests in small urban spaces, developed by Japanese botanist Akira Miyawaki, using high planting densities (3-5 saplings/m²) of multi-layered native species. This becomes self-sustaining and maintenance-free in 2-3 years, achieving 30-100 years of forest growth in just 20-30 years.

The Miyawaki plantation project was undertaken in Navi Mumbai, Thane District, Maharashtra, which comprises of 232 gardens covering an area of 200.86 hectares, and is managed by the Navi Mumbai Municipal Corporation (NMMC)⁷. The selected plantation sites at Jewel Garden (Nerul), Meenatai Thakare Udyan (Vashi), and Naga Gana Patil Udyan (CBD Belapur) are situated adjacent to high-density commercial and industrial corridors, particularly near MIDC zones. These urban green spaces play a critical role in functioning as ecological buffers, mitigating pollution, reducing urban heat islands, and offering essential recreational and psychological benefits to the surrounding communities. The impact assessment conducted by Deloitte is in the context of a Miyawaki afforestation initiative undertaken on degraded public lands at three sites in Navi Mumbai i.e., Jewel Garden (Nerul), Meenatai Thakare Udyan (Vashi), and Naga Gana Patil Udyan (CBD Belapur). As part of the intervention, over 25,000 native saplings were planted in May 2022, under a program that spanned February 2022 to March 2024, inclusive of the two-year post-plantation maintenance. The primary aim of the Miyawaki plantation initiative was to restore urban ecological integrity by fostering native biodiversity, lowering surface temperatures, enhancing carbon sequestration potential, and improving the resilience of green infrastructure within rapidly urbanizing zones. These interventions not only enhance ecosystem services such as air purification but also support climate adaptation and urban liveability in a region facing mounting ecological stress.

In parallel with national and global climate mitigation priorities, corporate institutions are increasingly integrating large-scale afforestation and reforestation initiatives within their Environmental, Social, and Governance (ESG) frameworks. Axis Bank Limited, as part of its CSR and climate action strategy, has committed to scaling up environmental interventions aimed at carbon sequestration and ecosystem restoration. According to its Integrated Annual Report 2024–25, the Bank has supported the plantation of approximately 3.27 million trees across India through a combination of conventional plantations, Miyawaki forests, and other afforestation programs. These initiatives have enabled it to achieve its initial target of 2 million trees by FY 2027 ahead of schedule. In recognition of the role of afforestation in climate mitigation and resilience building, this target was further extended to 8 million trees by 2030⁸. Such large-scale commitments emphasize the need for robust, field-based evidence on carbon sequestration performance of different plantation models to inform effective design, monitoring, and impact assessment of corporate-led climate interventions⁹.

SDG alignment¹⁰



⁶ Kukku Sara and Eswar Rajasekaran 2025 Environ. Res. Commun. 7 035027

⁷ Navi Mumbai Municipal Corporation Draft Development Plan 2018-2038 (DP Report), Maharashtra Regional and Town Planning Act, 1966

⁸ [Axis Bank Limited – ESG Agenda](#)

⁹ [Opportunity areas](#)

¹⁰ United Nations. (2015). Transforming our world: the 2030 Agenda for Sustainable Development

Key aligning points	<p>Target 11.7 aims to provide universal access to safe, inclusive and accessible green and public spaces, particularly in urban areas. The Miyawaki urban afforestation project supports this by converting degraded parks into dense, green spaces that enhance thermal comfort, biodiversity, and urban liveability.</p> <p>SDG 11: The project enhances urban resilience through greening of degraded brownfield spaces, contributing to improved air quality, biodiversity, and community wellbeing in Navi Mumbai.</p> <p>SDG 13: Native plantation contributes to carbon sequestration, urban heat island mitigation, and climate adaptation, aligning with India's Nationally Determined Contributions targets.</p> <p>SDG 15: Rehabilitation of degraded land using Miyawaki technique supports local ecosystems, enriches soil biodiversity, and promotes sustainable urban forestry.</p> <p>SDG 17: This initiative is a collaborative model involving Axis Bank, Green Yatra Trust, and NMMC, showcasing effective multi-stakeholder engagement in sustainable development.</p>
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1.2 Impact assessment findings overview

The Miyawaki method of forest restoration is an example of an ecosystem-based Nature-based Solution (NbS). Its application can be guided by and assessed using the IUCN Global Standard for Nature-based Solutions. One of the key criteria of the IUCN NbS framework is the longevity of the solution with its relationship with the societal challenges. Additionally, the input, activity, outcome and impact is reviewed through the RBM framework. The current report documents Deloitte's observations and findings of the impact assessment, adopting an integrated approach of both the NbS IUCN and RBM framework for the Miyawaki plantation project by Green Yatra Trust. A summary of findings is presented in the table below, while elaborate documentation is available in subsequent sections.

Criterion

Key Highlights

Relevance to Societal Challenges

- The Miyawaki plantation project contributes to urban heat mitigation objectives outlined under Maharashtra State heat preparedness frameworks and national climate resilience guidance. By increasing ward-level green cover in public gardens, the intervention supports indicators commonly used for monitoring climate adaptation, such as green space availability and urban cooling, thereby strengthening local resilience to heat stress.¹¹
- The plantation directly contributes to urban greening, air purification, and resilience-building, all of them are identified focus areas under the National Mission on Sustainable Habitat, part of India's National Action Plan on Climate Change.¹²
- The use of native species and protection of urban biodiversity directly supports targets on ecological restoration in urbanizing districts. The impact is also aligned to global biodiversity priorities under the Kunming-Montreal Global Biodiversity Framework (GBF), and leading to ecosystem restoration, species recovery, sustainable land use, ecosystem services, and urban biodiversity.¹³

Design at Scale

- The Miyawaki plantation model adopted done through the support of nurseries and hiring local vendors is scalable by design, integrating multi-layered local forest structures with clear scope for replication and improvement in future programmes.
- All project sites are currently in the thinning stage, following the growth–thinning–maturity cycle, with field observations indicating enhanced biomass accumulation through leaf litter, soil enrichment and increased microbial activity.
- Implementation strategically integrated Nature-based Solutions (NbS) with existing water infrastructure, leveraging nearby water bodies and treated

¹¹ Maharashtra State Adaptation Action Plan on Climate Change (MSAAPC) & National Mission on Sustainable Habitat 2021-2030

¹² National Mission on Sustainable Habitat 2021-2030

¹³ Updated National Biodiversity Action Plan in alignment with Kunming-Montreal Global Biodiversity Framework (2024-2030)

wastewater systems; notably, Jewel Garden uses an underground piped network (15-20 m intervals) supplying ~10 sprinklers for efficient, scheduled irrigation.

Biodiversity Net Gain

- The intervention demonstrates a net positive biodiversity outcome through the integration of 56 tree and shrub species across four forest strata (shrub, sub-tree, sub-canopy and canopy), strengthening vertical complexity, habitat heterogeneity and ecological resilience.
- Species composition is predominantly native and regionally naturalised, aligned with the Coastal Konkan–Western Ghats biogeographic zone, with a limited, intentional inclusion of non-native species for functional diversity and conservation value.
- The species mix exhibits high functional diversity, incorporating keystone, nitrogen-fixing, pollinator-supporting, soil-stabilising and livelihood-supporting species; notably, ~23% (13 species) have documented medicinal value, linking biodiversity enhancement with ecosystem services and traditional health systems.
- The plantation intentionally incorporates a small but meaningful presence of threatened species, including both Endangered and Vulnerable taxa, demonstrating a deliberate shift beyond conventional afforestation towards managed ex-situ conservation and proactive biodiversity stewardship.

Economic Viability

- The economic viability of the Miyawaki afforestation intervention was assessed using cost per surviving sapling, a practical indicator aligned with IUCN NbS Criterion 4, ensuring that financial efficiency is evaluated against actual ecological outcomes rather than planting numbers alone.
- The project investment covered plantation, two years of maintenance, monitoring and administrative costs, resulting in a high survival performance across sites and a realistic measure of value for money in an urban context.
- Overall, the intervention demonstrates cost-effective delivery, with expenditures translating into sustained tree survival, reflecting sound planning, efficient implementation and economic viability for urban Nature-based Solutions.

Inclusivity, Transparency & Governance

- The project promotes inclusive and accessible green spaces, ensuring that plantation sites remain open and explorable for all visitors.
- Implementation was carried out on municipal land with formal approvals and is being handed back to the local authority, supporting long-term stewardship.
- Transparency is strengthened through on-site information boards and the planned public disclosure of biodiversity assessment results.

Balance of Trade-offs

- The project effectively managed trade-offs by delivering nature-positive outcomes without disrupting existing public use, with no adverse community impacts reported.
- Site selection focused on underutilised and degraded urban land, optimising land repurposing for ecological restoration in line with NbS principles.
- The use of native and locally suitable species, avoiding invasive or high-maintenance plants, ensured low-maintenance management and long-term ecological sustainability.

Adaptive Management

- The diverse yet locally anchored species composition provides a strong basis for adaptive management, balancing local native species with a limited, controlled inclusion of other taxa to respond to site-specific and future climate stresses, enabling evidence-based species adjustments over time.
- Layer-wise performance observations informed on-ground adaptive decisions during planning and execution, including refinements in species mix and spacing,

**Sustainability and
Institutional
Mainstreaming**

**Ecosystem Services
Impact**

demonstrating the application of iterative, site-responsive management consistent with IUCN NbS Criterion 7.

- The project embedded long-term sustainability through formal approval, a defined maintenance period and structured knowledge transfer to the municipal Garden Department, supporting continued site upkeep.
- The project demonstrates clear climate co-benefits aligned with NbS mitigation and adaptation objectives, assessed through a combination of quantitative indicators and field-based observations.
- Improvements in ambient air quality were observed across most months, with stronger reductions during winter, indicating enhanced particulate filtering and dust suppression as canopy cover matured.
- Rapid and healthy biomass development was evident within two years, supported by dense canopy growth, natural leaf mulch, improved soil moisture retention and increased microbial activity.
- The plantations contribute to climate mitigation through carbon sequestration, with early rapid uptake transitioning to stable sequestration as the system matures.
- Climate adaptation benefits were observed through improved water infiltration and lower soil temperatures compared to control areas, highlighting the role of Miyawaki plantations in urban cooling, groundwater recharge and microclimate regulation.

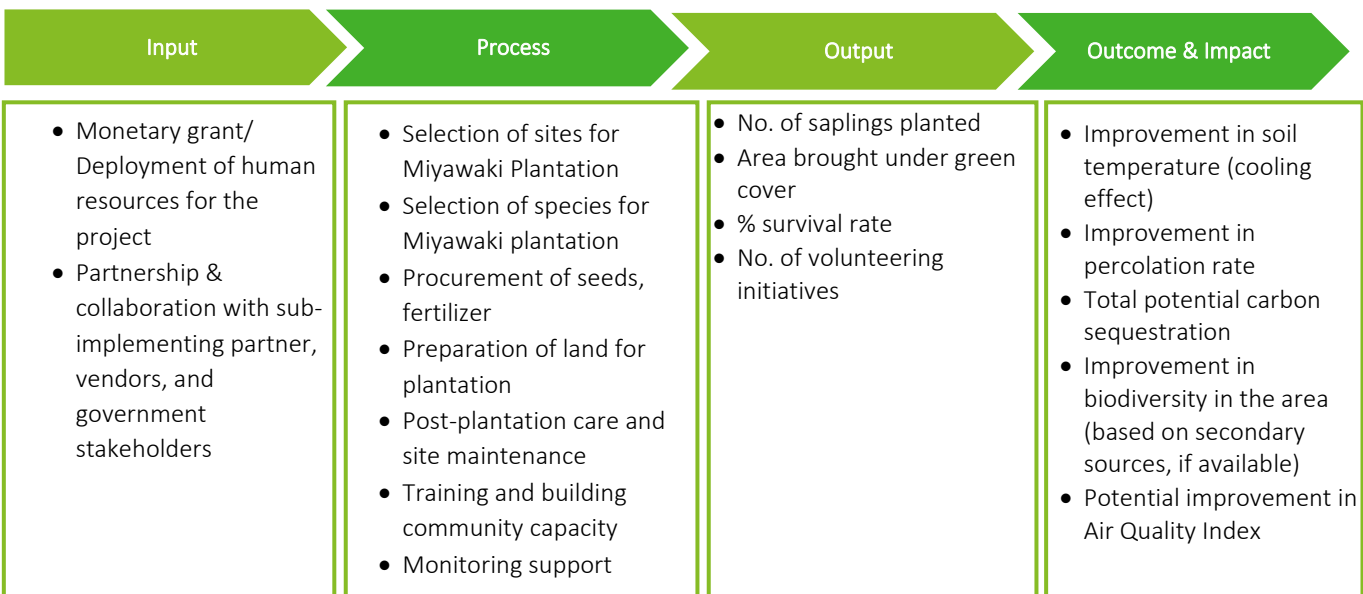
2. Approach and Methodology

For the assessment, a mixed-method strategy was adopted, centred around the collection of primary data through field visits, transect walks, focus group discussions (FGDs), key informant interviews (KIIs), and virtual interactions. Secondary data sources were reviewed to triangulate findings and ensure depth and evidence-based insights.

Field surveys were conducted using structured data collection tools to capture ecological and institutional parameters. These involved direct interactions with local inhabitants, government representatives, and implementing partners. The findings were further substantiated through the desk review of relevant reports, shapefiles, and project documentation. In addition to qualitative inputs, technical ecological assessments including tests for percolation, soil moisture, and species survival mapping were carried out to gauge post-plantation outcomes. These methods have been elaborated in Section 2.7.1.

2.1 Methodology for Impact Assessment

The below Key Performance Indicators (KPIs) along UNDP’s Results Based Framework were reviewed to assess the outcomes and impact of the project. Both primary and secondary project related data was considered, to gain a holistic understanding of the implementation model and outcomes.



Additionally, the project was reviewed from the lens of IUCN’s Nature-based Solutions (NbS) framework. Some of the key enquiry areas as per NbS were:

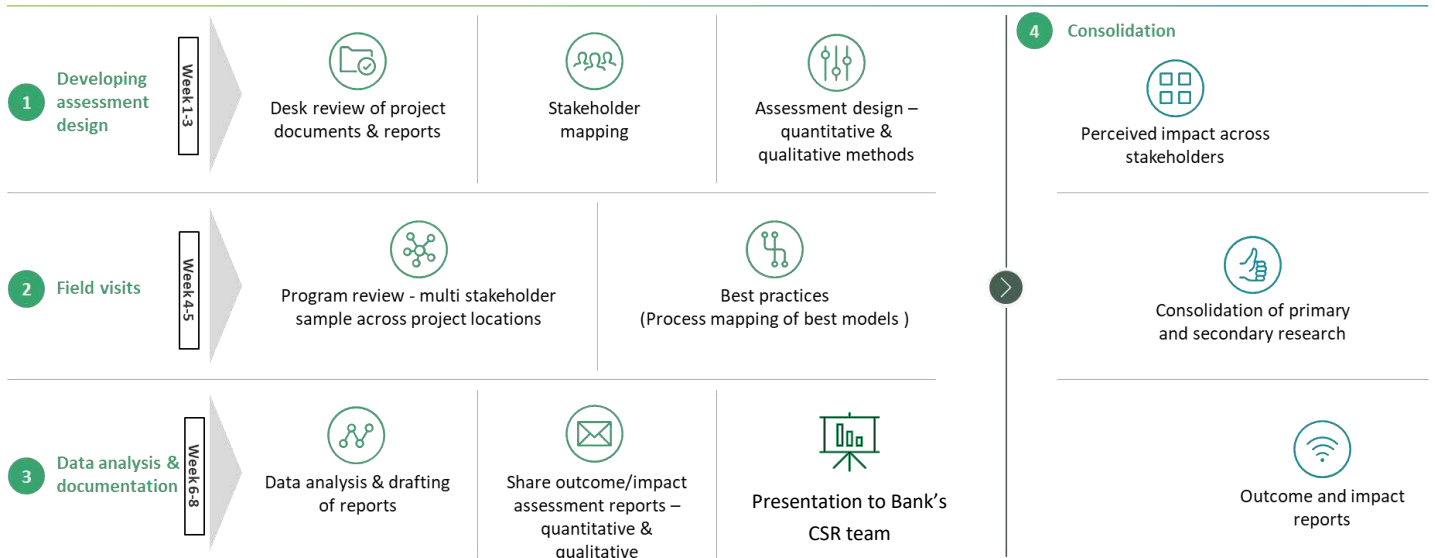


Based on the frameworks adopted, the indicators are mapped in the [Annexure 1](#), lensed mainly through IUCN NbS framework while also showcasing key impacts as ecological services integrated with RBM framework.

2.2 Study design

The impact assessment of the Miyawaki project was conducted through desk review and in-person visits to the three program sites across Navi Mumbai. The indicators listed were studied using both qualitative and quantitative methods, to ensure a holistic understanding of the project impact.

The assessment was carried out in following stages:



2.3 Desk review and secondary research

The study team conducted an introductory session with key members of the Implementation Partner (IP) Green Yatra, Miyawaki project team to understand the nuances of the project. The implementation team explained the project approach and shared the necessary documentation as part of preliminary desk review. Next, the team engaged in an in-depth desk review of the available documents to understand the project at length. Based on documents made available by Green Yatra, the secondary arm study was taken further to inform the primary research being undertaken in parallel.

Project documents reviewed as shared by the implementing partner:

- MoU
- Standard Operating Procedures
- List of stakeholders
- All site plantation list
- Project closure report
- Year-wise photographs of the site

2.4 Stakeholder Mapping

A stakeholder mapping exercise, based on the desk review, was conducted to identify the range of interactions that would be required to document multiple perspectives about impact. The documentation of insights from multiple stakeholder interactions will be critical to validate findings through triangulation. Stakeholder mapping for the current assessment has been presented below:



Primary Stakeholders

- Navi Mumbai Municipal Corporation (NMMC)
- On-field staff (maintenance)



Secondary Stakeholders and implementation team

- Local community visitors
- Program staff

2.5 Data collection strategy

2.5.1 Primary research

Primary research focused on gathering firsthand information from key stakeholders and direct observations at the implementation site:

- Field Visit Observations: On-site assessment of plantation height, density, layer of trees, thinning and an overall outlook of site at Jewel Garden (Nerul), Meenatai Thakare Udyan (Vashi), Naga Gana Patil Udyan (CBD Belapur)
- Key Informant Interviews (KIIs):
 - Programme lead (1)
 - Program team (3)
- Survey and group discussions with community members visiting the gardens frequently
- Sampling & Site Measurement: Plots were sampled to determine actual spacing, survival, and girth with different layers of trees for survival while soil temperature was measured for the plots and out of plots
- Water percolation was assessed using a variable-volume single-ring falling head infiltration method adapted from USDA NRCS (Soil Survey Field and Laboratory Methods Manual, SSIR-51) and FAO (Irrigation and Drainage Paper 70)
- All primary respondents and plots were selected using purposive sampling to ensure relevant insight and validation

2.5.2 Secondary research

Secondary research is being conducted to supplement and validate field findings through document analysis and published literature:

- Project Documentation: Analysis of project implementation documents, all site plant list, standard operating procedures, closure report, provided by the implementing partner (Green Yatra Trust).
- Scientific Literature: Carbon sequestration estimates from Roy, A., et al. (2025). Assessing carbon sequestration in urban Miyawaki forests of South India: Implications for climate mitigation planning and land suitability.
- Public Data Sources: Air quality data from monitoring station of Central Pollution Control Board (CPCB) in close range of project site.

2.6 Sampling plan

A multi-stage mixed methodology was adopted to identify the sample respondents for the study. The final set of the respondents were selected purposively. A snapshot of the stakeholders and the points covered is given as below:

Stakeholder	Key points covered	Study tools employed
Primary stakeholders	Pre vs Post implementation scenario (survival, density, percolation, area cover, soil temperature etc.) Operational feedback on the implementation and maintenance of the plantations Perceived impact (environmental and community)	Field survey, Focus Group Discussion (FGD), Key Informant Interview (KII)
Secondary Stakeholders	Feedback on the project Perception of impact Transfer and handover of the plantations Gap areas and needs that could be potentially bridged by CSR support	
Technical Survey	For validation, grid wise survival analysis or survival mapping, percolation tests, soil moisture and soil temperature	Working tool, Measuring tape, scale, PVC pipe of 110 mm diameter and 40 cm length Measuring containers (bucket, bottles), stopwatch and intelligent soil detector
Project management/field team	Program implementation Program monitoring	KII, FGD

Location	Sample size	Study tools employed
Jewel Garden (Nerul)		
Meenatai Thakare Udyan (Vashi)	Plantation – 27+ grids (Stratified) Visiting community members– 10 Trustee and program staff – 4	Field survey, Transect Walk, Visuals FGD/KII
Naga Gana Patil Udyan (CBD Belapur)		

2.7 Study tools

The details list of all the study tools and guidelines developed for each stakeholder is provided in the Annexure under the following headers as listed below:

- Transect walk:** A transect walk is a tool for describing and showing the location and distribution of resources, features, landscape, main land uses along a given transect¹⁴. It involves systematically walking through a landscape to observe and assess environmental and hydrological conditions along a defined path.
- Focus Group Discussion (FGD):** An FGD is a qualitative research method used for collecting data in which a homogeneous group of individuals are facilitated by a moderator towards exploring and unearthing a given topic in-depth¹⁵. The method helps in understanding the thoughts, perceptions, and attitudes of the group on several concerns in the interaction that allows the researcher to delve deeper into both the individual experience along with the collective narrative of the group. The FGD utilizes a semi-structured set of questions that guide the discussion where the moderator encourages equal participation to the discussion.

¹⁴ World Bank - [Transect Walk](#)

¹⁵ Eeuwijk and Angehrn (2017). How to conduct a focus group discussion (FGD). Methodological Manual.

3. **Key Informant Interviews (KII):** KII is a tool where the researcher can closely interact with the critical members or “key informants” of the project implementation team¹⁶. The key informant interview utilizes semi-structured guidelines to gather insights and observations made by the informant on a wide range of concerns related to the project implementation. These observations are then validated across different stakeholders.
4. **Technical Survey:** For such assessments, a technical survey is conducted to measure the ecological conditions of the site involving percolation, soil moisture, soil temperature with grid wise survival of different layers of trees undertaken in the plantation. The devices/tools used is shown in Figure 1 and Figure 2 as under:



Figure 1: Soil meter for temperature and moisture



Figure 2: PVC pipe & stopwatch for percolation test

5. **Visual Documentation (GPS/GIS Mapping and Photographs):** Documenting pre and post scenario using Google Earth Historical Imagery and gathering geo-tagged. In addition, the shapefiles of the project sites were reviewed to observe the area and green spaces.

2.7.1 Technical survey

To evaluate the ecological, hydrological, and biological impacts of the Miyawaki plantation intervention, a comprehensive set of field-based technical assessments was conducted across all three project sites. These assessments included:

- i. Infiltration (percolation) tests
- ii. Soil microclimate analysis (moisture and temperature)
- iii. Grid-based plantation survival analysis

Comparative observations were also recorded from adjacent non-plantation control areas to isolate the influence of the intervention. The overall methodology draws from simplified and context-adapted protocols referenced in the USDA NRCS Soil Survey Manual (SSIR-51) and the FAO Irrigation and Drainage Paper No. 70, enabling rapid ecological appraisal within urban green spaces. For survival assessment, a grid sampling approach was adopted using multiple 1 m × 1 m quadrats (27+ per site), enabling detailed, spatially distributed observations on sapling survival rates, plant health conditions, and site-level variability. This method helped triangulate field-level performance with species selection, plantation density, and maintenance practices. Together, these methods provided a holistic understanding of how the Miyawaki plantations affect soil infiltration capacity, moisture retention, temperature moderation, and vegetation persistence-key indicators of ecological restoration success in densely urbanized zones.

A. Equipment Used

The following tools and instruments were used during the technical field assessments:

- PVC pipe (110 mm diameter, 40 cm length)
- Measuring containers (5-litre bucket and 2-litre bottles)
- Stopwatch
- amiciSense 6-in-1 Intelligent Soil Tester (for soil moisture %, soil temperature and other indicators)
- Measuring tape and marker flags for grid demarcation
- Field notebook for data logging and observations

B. Site Selection

Technical assessments were conducted at:

- Miyawaki plantation sites, with multiple sampling locations selected within each site; and

¹⁶ MN Marshall (1996). The key informant interview technique.

- Adjacent control sites where no plantation activity had been undertaken

This paired-site approach allowed direct comparison of soil hydrology, microclimate conditions, and vegetation outcomes attributable to the Miyawaki intervention.

C. Single-Ring Infiltration (Percolation) Test

A single-ring falling-head infiltration test was used to assess soil permeability and infiltration capacity. This method was selected due to its suitability for urban field conditions and variable water availability.

Pipe Placement

A 110 mm diameter PVC pipe was inserted approximately 5 cm into the soil at each test location to minimize lateral leakage.

Water Volumes Applied

- Site 1 – Jewel Garden: 5 litres (bucket)
- Site 2 – Naga Gana : 4 litres (2 × 1-litre pours)
- Site 3 – Meenatai Thakare : Piped water (volume unmeasured; time-to-infiltrate recorded)

Procedure

1. Water was poured into the pipe until a visible water column formed.
2. A stopwatch was started immediately.
3. The total time required for complete infiltration was recorded.
4. Tests were repeated to improve reliability of observations.

Calculation

Where applied volume was known, the percolation rate was calculated as:

$$\text{Percolation Rate} \left(\frac{l}{min} \right) = \text{Applied Volume (l)} / \text{Total Time (min)}$$

Where applied volume was unmeasured, results were reported as time-to-infiltrate, consistent with falling-head infiltration principles

D. Soil Moisture and Soil Temperature Measurement

Soil parameters were assessed mainly temperature for understanding cooling effect and moisture relative to percolation:

1. Measurements were taken at a depth of 0 to 12 cm, corresponding to the active root zone
2. Readings were recorded immediately prior to percolation tests to capture antecedent soil conditions

E. Plantation Survival Analysis Using Grid Sampling

To assess plantation survival and vegetation persistence, a grid-based sampling approach was adopted.

Grid Design

- Grid size: 1 m × 1 m (1 m² quadrats)
- Total grids sampled: 27+ grids across all three sites
- Grids were randomly distributed to capture variability in shade, soil condition, slope, and watering access.

Methodology

1. Each grid was demarcated using measuring tape and marker flags
2. Within each grid, the following observations were recorded:
 - Number of surviving saplings
 - Visible plant health condition (vigour, stress, pest damage)
 - Presence of litter, mulch, or exposed soil
3. Grid-wise survival data were aggregated to estimate overall survival trends at the site level and to identify spatial variations influenced by micro-site conditions.

$$4. \text{Average weighted survival} = \frac{\sum(\text{Saplings at site} * \text{Survival \% at site})}{\sum(\text{Total saplings})} * 100$$

2.8 Limitations

- The project was implemented from February 2022 to March 2024, and the analysis and findings in the report rely on data collected in November 2025, one and a half years after project completion. As a result, the findings depend on and reflect both the participant's memory and recall of the program and their immediate results.
- The findings of the review are limited to the scope of the provided documentation, accuracy of the information shared by the implementing partner and continued unavailability of garden department leading to no conduct of meeting with the garden department during the study period.

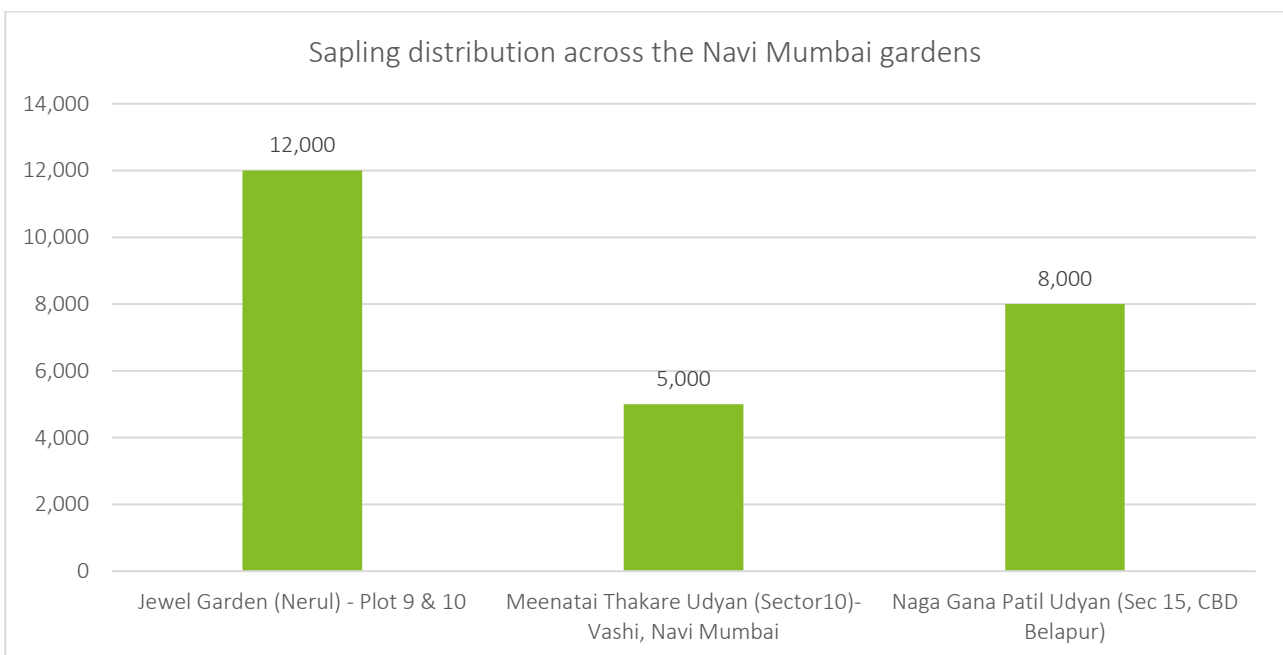
- Carbon sequestration estimates are based on secondary literature (Anirban Roy, Merlin Lopus, Sruthi Surendran, Amit Kushwaha, K.A. Sreejith, K.C. Akhila, G. Anna, P. Saranga, N. Sethulakshmi, Deepak Jaiswal, Assessing carbon sequestration in urban Miyawaki forests of south India: Implications for climate mitigation planning and land suitability, Trees, Forests and People, Volume 21, 2025, 100925).
- Survival estimates are based on selective sample plots and weighted average was adopted for the measured quadrats.
- Air Quality Index (AQI) trends are influenced by multiple external factors, including regional meteorology, vehicular emissions, industrial activity, construction controls and broader air pollution management measures. While observed AQI improvements are consistent with the known co-benefits of increased urban green cover, isolating the specific contribution of the Miyawaki plantation intervention is not feasible in the absence of a controlled, site-specific monitoring framework. AQI is therefore presented as an indicative, indirect co-benefit rather than a direct impact of the intervention.
- It is acknowledged that a more robust experimental design could have included additional control plots in nearby gardens or in non-vegetated or sparsely vegetated areas such as school grounds or barren urban parcels. Despite this limitation, the observed differences provide strong indicative evidence of the enhanced hydrological and microclimatic functions associated with Miyawaki-style plantations.

3. Project output¹⁷ and outcomes

The below Key Performance Indicators (KPIs) along with an integrated framework of UNDP’s Results Based Framework and IUCN’s Nature-based Solutions (NbS), were used to assess the outcomes and impact of the project. Both primary and secondary project related data was reviewed to gain a holistic understanding of the implementation model and outcomes.

3.1 Input

- The total grant of INR 1,50,00,000 from Axis Bank Limited, supported the Miyawaki Plantation project from February 2022 to March 2024 for plantation activity and maintenance support.
- A pre-assessment to assess site suitability was conducted by Green Yatra Trust and to evaluate the scale of work required in coordination with NMMC.
- Further to this, Green Yatra Trust team partnered with vendors to execute the activities under their supervision
- The Axis Bank Limited. supported program was implemented by Green Yatra Trust in collaboration with Navi NMMC in three gardens/sites namely Jewel Garden (Nerul), Meenatai Thakare Udyan (Vashi), Naga Gana Patil Udyan (CBD Belapur).
- The project undertook plantation with 56 different types of species as shown in [Annexure 2](#).

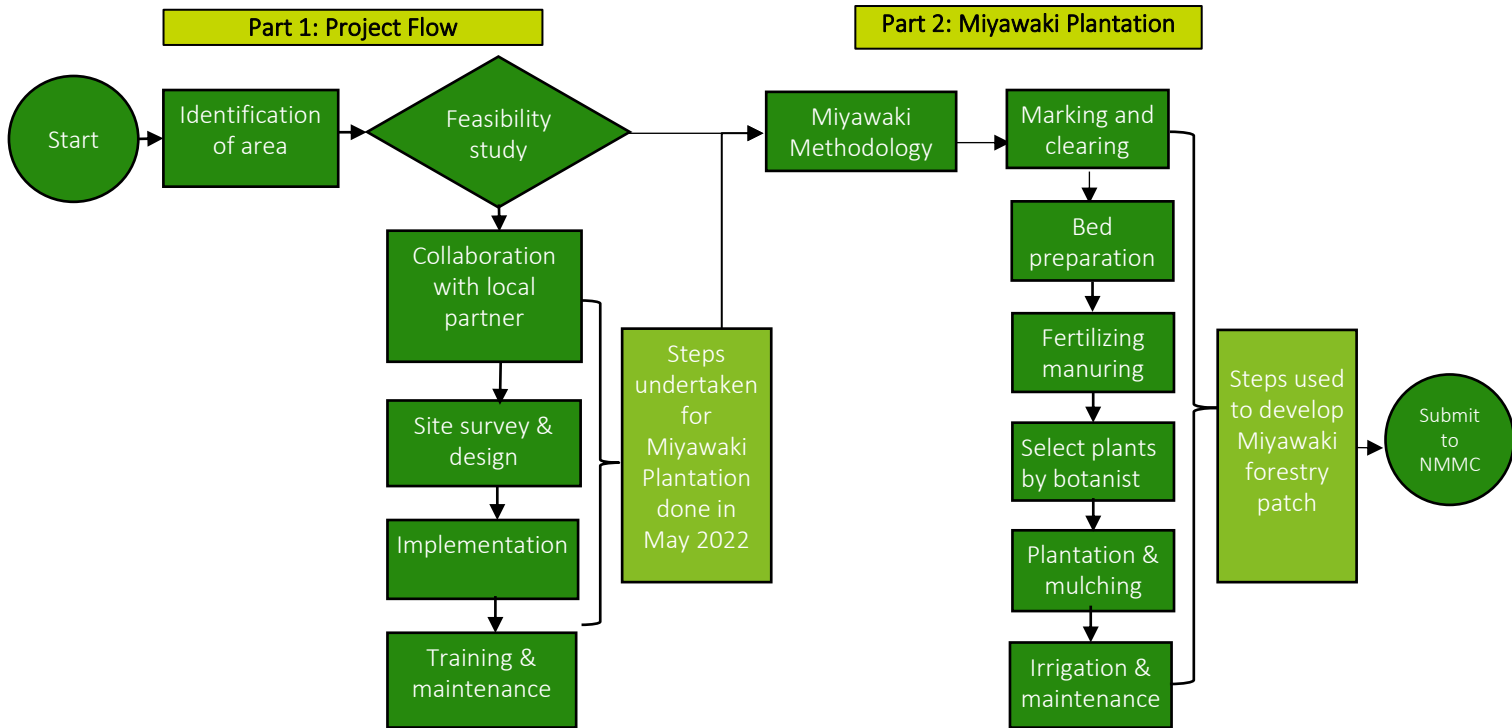


¹⁷ MoU between Axis Bank Limited and Green Yatra Trust signed on 3rd March 2022

3.2 Process and actions

3.2.1 Project model

The below processes were carried out with regards to 3 sites for 25,000 plantations (As per RFP):



3.2.2 Activity

This section outlines the set of actions implemented under the Miyawaki plantation project to deliver its intended results.

Activity/Process	Description
------------------	-------------

Scoping and Site Identification

- As the objective of the Green Yatra Trust is to enhance green cover in the urban areas, site assessments were undertaken in the shortlisted locations communicated by the NMMC to determine plantation suitability as a part of collaboration. The key parameters assessed during this step were to check if the area had consistent supply or availability of water and electricity, no overhead wires, underground pipelines or wiring. Such assessments are made in consultation with the local authority and by reviewing maps or secondary data. This whole scoping exercises sometimes takes more than a year to finalise. Further, the elevation, soil and heat conditions or any other criticality of the area was also assessed to check that the selected site would not pose any risk to the survivability of the plantation. The plantation site was then divided into plots, as observed on field. As reported by the Green Yatra, the number of plots in the Jewel Garden are 2 while Naga Gana Park and Meentai Garden both have one plot which are supported by Axis Bank Limited. Further, soil tests were conducted, of the selected sites, to select the plants and for optimal fertilising

Tree Species Selection

- A botanist from the team of Green Yatra Trust visited the local forest and assessed the native, non-native and local native plantation categorised into four layers of plantation - canopy trees, trees, sub-trees and shrubs. The plants were then finalised keeping in view the soil type, quality tests conducted by the IP, climatic suitability and excluding non-native plants

Procurement

- As reported by the Green Yatra Trust during KII, they trained the competitive nurseries keeping in view the quality metrics and the wide variety of species they require. Competitive quotations were collected and saplings assessed for root health and quality

Bed Preparation

- Weed/invasive species removal and tilling was undertaken to prepare a bed of 1 meter depth and fertilised with soil inoculant (*Ghanajeevamrit*) to boost microbial activity and fertility basis soil requirement. During this process the supervisor from the project team visited once in a week to monitor progress while the field team oversaw the ongoing daily work

Composting

- The compost used for the Miyawaki plantation by the IP was cocopeat and rice husk and depending on the soil results, the amount and ratio of compost required was calculated for application during bed preparation

Plantation Execution

- The finalised plants selected from native and local native for four different layers were planted using Miyawaki method (3-4 saplings/sq. meter); fertilisation and mulching is done in the planted area while organic fertiliser (*Jeevamrut*) is applied twice a year which is standardised for all beds

Community & Volunteer Engagement

- Organising community workshops and engagement programs is usually done by NMMC, in which Green Yatra Trust is not involved

Watering & Post-Plantation Maintenance





- At Jewel Garden as observed, an underground piping network with both main and sub-lines has been installed to support sprinkler-based irrigation, and a defined schedule ensures timely watering using treated water supplied through the STP pipeline. At the Meenatai Thakare Udyan site, watering is carried out using hose pipes, and natural mulching with dry leaves is commonly observed across the plantation areas. As reported during KII, weed-control measures and general maintenance are undertaken at all three sites for up to two years after plantation. Beyond this period, the implementing partner continues to monitor the project for up to a decade as part of their long-term stewardship

Institutional Handover

- After two years, the responsibility for site management is handed over to the local authority, NMMC. Green Yatra Trust provides training to NMMC gardeners to ensure the sustainable upkeep of the site

3.3 Afforestation through Miyawaki Plantation

A snapshot of the outcome of the Axis Bank supported Miyawaki plantation project is presented below:

	<p>3 Gardens in Navi Mumbai Directly impacting the community and nearby ecosystem</p>
	<p>25,000 Plantation Planted across all locations</p>
	<p>8,332 square meters i.e. 0.8 Hectares Covered across all locations</p>
	<p>56 Unique Species Diversity across all locations</p>

3.4 Outcome and Impact

To assess the Miyawaki plantations’ performance across ecological, institutional, and social dimensions, this section presents a criterion-wise analysis based on the integrated Nature-based Solutions (NbS) framework by IUCN and the Results-Based Management (RBM) framework by UNDP. Indicators were drawn from the final matrix and analysed using data from field assessments, stakeholder consultations, and technical surveys.

Relevance to Societal Challenges (Criterion 1 – NbS)

The project addresses the daily societal challenges faced by inhabitants of NMMC and the initiative was found to align well with broader urban resilience and sustainability goals:

- As the cities are known to grapple in heat waves every summer, the Miyawaki plantation has led to increase in green cover of the three wards numbered 98 – Jewel Garden, 107 – Naga Gana Park and 60 – Meenatai Thakare Udyan, covering an area of 8,331 square metres, and acting as a cooling buffer. The before and after photographical outlook of all sites is given in Annexure 6.3 while the scenario of sites is captured using Google Earth for before and after which is exhibited below:



- The total area of NMMC is reported to be 10,95,90,000 square metres. The NMMC area has 232 gardens covering an area of 20,08,300 square metres which covers 2% of NMMC. The percentage increase in green cover across three wards, spanning an area of 93,31,113 square metres, is **0.09%** attributable to Miyawaki plantation.
- The proportion of green space per capita varies can be contextualized to the region of interest. Experts from Germany, Japan and other countries proposed 40 square metres green space to be of high quality, or suburb forest of 140 square metres per capita to attain ideal balance between carbon dioxide and oxygen for meeting the ecological need of human well-being. As of now, developed nations tend to adopt a standard of 20 square metres park area per capita¹⁸. The projected population based on percentage growth method of NMMC is reported to be 32.6 lakh in 2028 and the area under NMMC is 10,95,90,000 square metres; considering all the gardens are having 100% green space, per capita green area comes to be 0.65 square metre which is way below the WHO recommended green space per capita of 9 square metre per person. Further, as per the land use of NMMC, forest area of is reported to be 8 square metre per capita which is again way below the norms for ecological balance of human wellbeing. **The initiative has led to increase** in dense green space within the garden/parks for human well-being and mitigating urban challenges like local temperatures, improve air quality by reducing pollutants, sequester carbon, and improve the wellbeing of residents, as well as creating a natural oasis for invertebrates and birds.
- Based on the Kunming-Montreal Global Biodiversity Framework, the project has made sustainable use of degraded lands for urban biodiversity, ecosystem restoration and services.

Design at Scale (Criterion 2 – NbS)

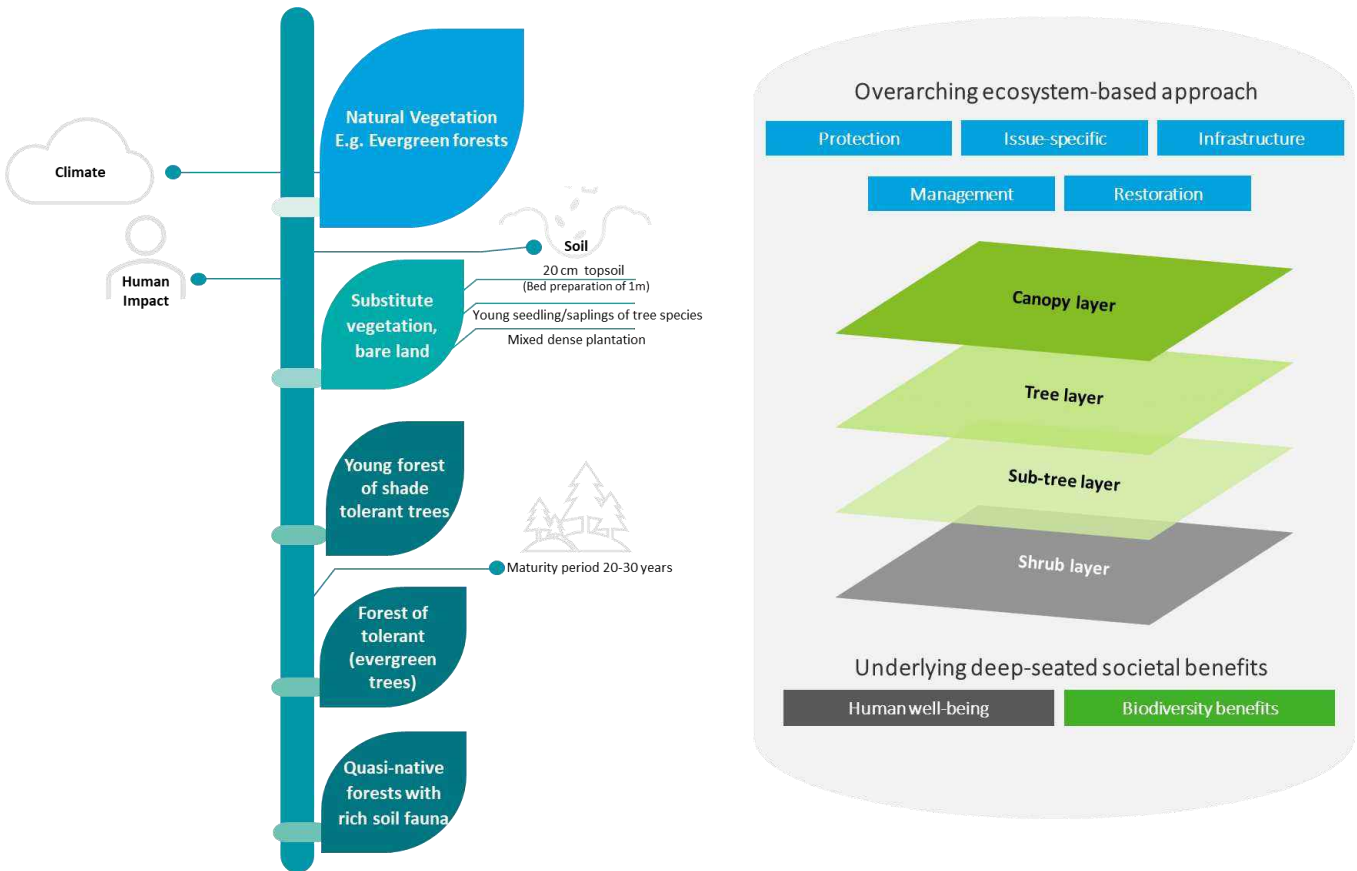
The project laid down an efficient scoping mechanism to identify the areas which ensures long term sustainability of interventions which is also briefed in activity. However, the step-by-step process of Miyawaki plantation as suggested by Dr. Akira Miyawaki¹⁹ involves an ecological engineering approach using the forest reconstruction method. The method is based on the knowledge of the following:

1. The potential natural vegetation (PNV) of the site
 - Potential vegetation refers to “an abstract concept of a vegetation made up of the plant species present in remnants of the plant cover, without human influence.” A thorough analysis of the existing vegetation type, local topography and an understanding of inter and intra species relationships, as well as with the surrounding environment helps in determining the potential vegetation of the site. Information about the potential vegetation of a site is important to reconstruct a forest with native tree species that mimics the functioning of a natural forest
2. Germination and establishment biology of seeds from specimen plants in a nursery
 - For the purpose of developing strong root systems to increase the rate of seedling survival in a forest, collection of seeds of the specimen plants which comprise the potential vegetation is important. This will help to ensure successful seed germination in the nursery. For this, seeds need to be sown in pots, and after a period of two years, the seedlings could be planted at the actual site
3. Procedure of planting of seedlings in a forest
 - The final procedure of planting seedlings in a forest includes the following steps:
 - Site preparation: This step involves the ploughing of soil on site to prepare the surface for planting of seedlings. Planting beds or low mounds of soil could be created to check harm caused due to flooding or heavy rains. In addition, mulching of planting beds with straws and organic fertilizer could be carried out to avoid potential damage to the seedlings.
 - Planting of seedlings: The process of planting seedlings in a forest is specifically ceremonious in nature in Japan and largely community driven. This helps to instil ecological values amongst the people as well as to develop a forest with a “complex pattern of trees.” Volunteers and participants could be guided to plant seedlings in pre-dug holes, followed by spreading of mulch.
4. Post-plantation care: The method does not necessarily require further site maintenance after the plantation of seedlings. As has been observed, the success rate of survival of seedlings in the first year is more than 90% and the forest tends to grow fast such that a closed canopy is developed within a span of five years. The method also facilitates a natural competition between species thereby leading to a development of a quasi-natural Miyawaki forest.

¹⁸ Norms for Urban Green Spaces (Urban Green Guidelines, 2014)

¹⁹ ICLEI South Asia (2022) Guidelines for development of Miyawaki Forests in India. Prepared under SDC Supported CapaCITIES II project

Topography of Miyawaki plantation and its environmental implications



Source: Inspired from Guidelines for Development of Miyawaki Forest and IUCN Framework.

- Based on the Guidelines for Development of Miyawaki Forest laid down and reviewed by ICLEI, South Asia for Indian context, the project has followed the design principles as suggested by Dr. Akira Miyawaki. As reported by implementing partner during the KII, the project initiates with assessment of potential natural vegetation → establishment of nurseries (partnering for the supply of native and local native species) → site preparation (involving soil test, bed preparation fertilising and manuring) → plantation of saplings (involving determination of native species) → post-plantation care (mulching, maintenance with regular organic fertilizer application, training and handover as described in activity). The steps adopted (considering different layers of local forest) are scalable by design and certain actionable recommendations may be taken in future programmes as given in way forward.
- The three stages of Miyawaki forest plantation involves growth, thinning and maturity stage. Currently, the project sites are ongoing thinning cycles as observed on field and enhancing the biomass through leaves shedding and improved microbial activity.
- The project was implemented considering the water bodies and water sources nearby for blending NbS with built infrastructure i.e., wastewater supply and water pumps for efficient irrigation scheduling. The Jewel Garden was also found with underground piping systems with connections at 15-20 m for approximately 10 sprinklers making use of treated wastewater for irrigation.

Net gain to biodiversity and ecosystem integrity²⁰ (Criterion 3 – NbS)

Floral Diversity:

The intervention demonstrates a net positive biodiversity outcome through the integration of 56 tree and shrub species across four forest strata (shrub, sub-tree, sub-canopy, and canopy), enhancing vertical structure, habitat heterogeneity, and ecological resilience. Quantitative biodiversity indicators derived from the species dataset indicate:

- Species richness: 56 species, comprising a predominantly native and regionally naturalized species assemblage, with a limited number of non-native or region-external species intentionally included for functional diversity and conservation purposes. Coastal Konkan region of Maharashtra biogeographic influence zone species forms the core of the plantation design, supporting alignment with ecological conditions.
- Threatened species share²¹: 4 out of 56 species (~7.0%) are classified as globally threatened under the IUCN Red List, reflecting a deliberate contribution to species conservation beyond common afforestation practices.
 - Endangered (EN): 2 species
 - *Pterocarpus santalinus* (Red sanders or Lal Chandan) – included as an ex-situ conservation measure, as the species is endemic to Andhra Pradesh and does not naturally occur in the Coastal Maharashtra (Konkan), ecologically influenced by the Western Ghats
 - *Tectona grandis* (Teak)
 - Vulnerable (VU): 2 species
 - *Saraca asoca* (Sita Ashok)
 - *Garcinia indica* (Kokum)
- The inclusion of threatened and regionally non-native species is explicitly positioned as managed ex situ conservation, complementing in situ restoration of native species. This approach enhances overall biodiversity value while avoiding claims of strict Potential Natural Vegetation (PNV) replication for these specific taxa.
- The species assemblage exhibits high functional diversity, including keystone, nitrogen-fixing, pollinator-supporting, soil-stabilizing, and livelihood-supporting species. Notably, 13 out of 56 species (~23%) have documented medicinal value (e.g., *Azadirachta indica*, *Phyllanthus emblica*, *Aegle marmelos*, *Saraca asoca*, *Terminalia arjuna*), strengthening the linkage between biodiversity conservation, ecosystem services, and traditional healthcare systems, while enhancing the overall resilience and socio-ecological value of the NbS intervention.
- The plantation shows a balanced, multi-layered forest structure, with ~60% tree layers (sub-canopy + canopy) ensuring long-term structural stability, and ~30% understory (shrub + sub-tree) supporting habitat complexity, regeneration, and biodiversity functions.

Faunal Diversity:

Faunal observations recorded 30+ species across multiple taxonomic groups, dominated by native resident fauna with a limited presence of migratory and wetland-associated species. The assemblage is largely classified as Least Concern (LC) under the IUCN Red List, with several taxa remaining Not Evaluated (NE) due to global assessment gaps in invertebrates. Notably, the presence of conservation-relevant and legally protected species indicates improving habitat quality and provides evidence of net biodiversity gain within the restored urban landscape.

- Avifaunal Diversity and Habitat Utilisation
 - The presence of multiple bird species including herons, egrets, weavers, sparrows, doves, drongos, sunbirds and wetland-associated birds reflects enhanced habitat heterogeneity and trophic functionality within the plantation sites. These species represent diverse feeding guilds (insectivores, granivores, omnivores and wetland foragers), demonstrating improved prey availability, seed resources and micro-habitat conditions generated by the plantation intervention.
 - The utilisation of landscapes nearby plantation sites by migratory birds (*Phoenicopus minor*, *Black Redstart*) indicates strengthening urban ecological connectivity and increasing habitat suitability for mobile taxa, supporting early-stage faunal recolonisation.
- Reptilian Presence and Micro-Habitat Restoration
 - The confirmed presence of Oriental Garden Lizard (*Calotes versicolor*) and Russell's Viper (*Daboia russelii*) provides robust evidence of ground-layer habitat stability, prey availability and reduced disturbance. As low-

²⁰ BGCI 2025. GlobalTree Portal. Botanic Gardens Conservation International. Richmond, U.K.

²¹ Source: BGCI PlantSearch, 2024 and Protected Planet, 2019

mobility, site-fidelity taxa, reptiles serve as stronger indicators of on-site ecological integrity than avifauna alone, confirming successful micro-habitat restoration.

- Invertebrate Assemblages and Ecosystem Services
 - The observation of pollinators (butterflies, bees) and predatory invertebrates (dragonflies, wasps) indicates improving pollination services, biological pest regulation and food-web support. These invertebrate communities underpin higher trophic-level recovery and contribute to overall ecosystem resilience within the plantation sites.
 - The presence of geometer moth larvae (inchworms) within the plantation area indicates successful establishment of foliage-dependent invertebrates and early-stage development of trophic food-web linkages supporting insectivorous fauna.



Figure 3: Oriental lizard (Left) spotted at Jewel Garden and Cattle Egret (Right) spotted in vicinity of Meenatai Thakare Garden



Figure 4: Observation of Geometer moth caterpillar

- Integrated Multi-Taxa Biodiversity Recovery
 - The concurrent presence of birds, reptiles and invertebrates demonstrates the emergence of a functioning urban micro-ecosystem supported by the Miyawaki plantation intervention. The spotting of multiple trophic groups ranging from primary consumers to mid-level predators indicates an improved habitat quality, ecosystem functionality and ecological stability.
 - Collectively, the observed faunal diversity provides robust early-stage evidence that the intervention is delivering biodiversity enhancement, habitat provisioning and ecosystem services, consistent with IUCN NbS Criterion 3 (Biodiversity Net Gain).

Economic Viability (Criterion 4 – NbS)

The economic viability of the Miyawaki afforestation project is assessed using the metric of cost per surviving sapling, a core indicator under Criterion 4 of the IUCN NbS Framework. This approach not only evaluates financial efficiency but also accounts for actual survival outcomes across different sites, thereby providing a more realistic cost-benefit estimate.

- The project incurred a total cost of 1,50,00,00 INR, including two years of maintenance, monitoring and admin charges.
- Across 25,000 saplings planted, the weighted survival is 77.8% resulting survival of 19,450 plants.
- The cost per planted sapling is 600 while the cost per surviving sapling is ₹771 from the planning phase to execution while involving logistics, saplings and labour cost showcasing economic viability in urban context.

Inclusive, transparent and empowering governance processes (Criterion 5 – NbS)

The Miyawaki afforestation project demonstrated initial steps toward inclusive governance through its structured engagement with key institutional stakeholders.

- The project is implemented in collaboration with Navi Mumbai municipal Corporation (NMMC) which ensures inclusive environments for all visitors and hinders no access. As reported during KIIs, volunteering activities were undertaken by funder's employees and implementation partners, involving tasks such as site cleaning, de-weeding, and watering. Approximately 10-12 volunteer events were held, each engaging 60-70 unique volunteers, resulting in the participation of around 600-700 employees over the project period.
- The project sites are located on land governed by Navi Mumbai Municipal Corporation (NMMC), with written permissions obtained prior to implementation and is handed over to the local municipal corporation after completion of activities as mentioned during the KIIs.
- Informational boards are installed at each site to improve visibility and transparency. Moreover, during Key Informant Interviews (KIIs), it was reported that a Biodiversity Assessment is being conducted by the implementing partner (IP) and is intended to be made public. This reflects a transparent intent for open dissemination of impact results.

Balance of Trade-offs (Criterion 6 – NbS)

The project demonstrates effective management of trade-offs through strategic decisions that align with nature-positive outcomes while minimizing unintended negative impacts.

- The plantation areas are in urban public parks that remained open and accessible for community recreation. No negative feedback or functional displacement of local users was reported.
- All three plantation sites were established on underutilized or degraded urban patches, including brownfield-like conditions in parts of Jewel Garden and Meenatai Thakare Udyan. This choice reflects optimal land repurposing in line with NbS principles of using non-productive land for ecological restoration.
- No Use of Invasive / High-Maintenance Species was reported to be planted by the IP. The palette of native and locally suitable saplings selected aligns with Miyawaki principles of low-maintenance, fast-growth native afforestation.

Adaptive Management (Criterion 7 – NbS + RBM)

- The Miyawaki plantation is practiced in multiple parts of the world for accelerated growth of plants to improve ecological and climate resilience mainly in limited availability of lands which is evidently observed through greening initiatives in urban settings.
- The species composition provides a strong foundation for adaptive management, with ~59% local native species (33) ensuring baseline ecological stability aligned with the coastal Konkan Potential Natural Vegetation, while ~29% India-native (16) non-local species and a limited ~12% non-native (7) or cultivated species offer controlled flexibility to respond to site-specific stresses such as coastal microclimate variability, soil conditions, and future climate risks.
- Layer-wise survival outcomes observed during plantation implementation indicate higher establishment in the canopy layer (93%), compared to the sub-canopy tree layer (26%), sub-tree layer (26%), and shrub layer (37%). Guided layer-specific management during plantation, including adjustments in species mix and spacing was undertaken to improve overall stand establishment. This demonstrates that adaptive management was applied at the planning and execution stage, with plantation decisions informed by local forest visits.

Sustainability and Institutional Mainstreaming (Criterion 8 – NbS)

- The planted sites had a defined 2-year maintenance plan and knowledge dissemination on maintenance to local municipal corporation. The role of the local corporation Garden Department involves regular watering and has

established waste management system negligible litter was observed in all the sites showcasing the institutional framework and its governance system.

- Plantations are increasingly referenced in city's ward-level greening and Smart City reporting which is the key driver in ensuring the long-term protection of sites.

Ecosystem Services Impact (Cross-cutting key findings – NbS + RBM)

To assess the climate co-benefits of the Miyawaki plantation interventions, a set of quantitative and observational indicators were used. The assessments are designed to align with the NbS criterion for climate mitigation (e.g., carbon sequestration and air quality improvement) and climate adaptation (e.g., temperature regulation, and infiltration rate).

a. Carbon Sequestration (Climate Mitigation Service)

- Carbon sequestration rates in plantation forests vary substantially depending on planting density, species composition, and stand structure. According to the IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 2006; 2019 Refinement) and FAO forest carbon stock assessments (FAO, 2018; 2020), conventional tree plantations typically sequester 3-8 Mg C ha⁻¹ yr⁻¹ during peak growth phases, accumulating 40-120 Mg C ha⁻¹ over a 30-40 year rotation period, with typical planting densities of 400-1,000 trees ha⁻¹.
 - In contrast, Miyawaki-style dense native plantations, characterized by very high stem densities (10,000-30,000 trees ha⁻¹) and diverse native species assemblages, exhibit substantially higher early-stage carbon sequestration per unit area. The implemented project also reported an average of ~30,000 trees per hectare. Recent peer-reviewed field studies from India and other tropical regions report sequestration rates ranging from 5-35 Mg C ha⁻¹ yr⁻¹ during the first decade of growth (Suganuma & Durigan, 2015; Kumar et al., 2021; Sharma et al., 2023).
 - Under favourable site conditions and during the initial establishment phase, these values indicate that Miyawaki plantations can sequester up to ~30 times more carbon per unit area than newly established conventional plantations, particularly when comparisons are made against low-density plantations in their early growth years. Field-based measurements from south India further demonstrate a strong age-dependent increase in sequestration, with Miyawaki forests sequestering 5.284 Mg C ha⁻¹ yr⁻¹ at 2 years, 20.042 Mg C ha⁻¹ yr⁻¹ at 4 years, and 33.084 Mg C ha⁻¹ yr⁻¹ at 5 years, based on Diameter at Breast Height (DBH) and height-derived allometric equations²². Although individual trees in Miyawaki plantations store less carbon than widely spaced trees in conventional plantations due to smaller stem diameters, overall per-hectare carbon sequestration is typically 5-10 times higher during the first decade.
- Visual field assessments indicate robust biomass development within approximately 2.5 years, with canopy trees reaching average girths of ~30 cm, sub-canopy trees ~12 cm, sub-trees ~10 cm and shrubs ~4 cm, and overall patch heights of ~10-12 m.
- Plantation plots were observed to be covered with leaf litter acting as natural mulch, supporting in-situ moisture conservation, enhanced microbial activity and ongoing biomass accumulation, reinforcing the plantation's role in long-term carbon sequestration.
- The carbon sequestration rates were calculated based on the research with species relation of 37% match with the plantation sites located in Jewel Garden, Naga Gana Park and Meenatai Thakare.²²
- While Miyawaki plantations exhibit rapid carbon sequestration during early growth stages, the rate stabilizes over time as the plantations mature. At the end of five years, close to mid of thinning stage, the combined sequestration potential across all sites is estimated at approximately 1 lakh kg CO₂ per year.

²² Assessing carbon sequestration in urban Miyawaki forests of south India: Implications for climate mitigation planning and land suitability

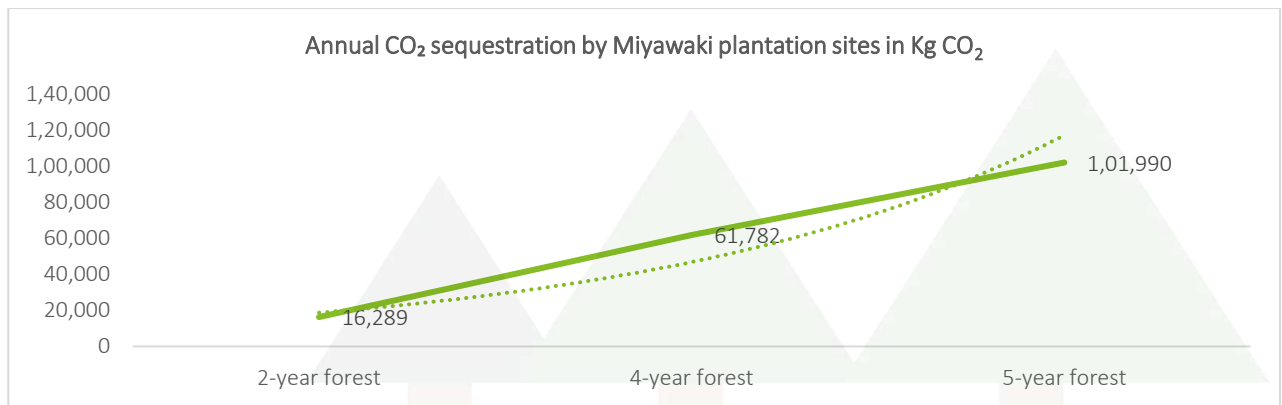


Figure 5: Annual sequestration by Miyawaki Plantation sites

Note: Annual CO₂ sequestration was calculated by converting carbon sequestration rates ($Mg\ C\ ha^{-1}\ yr^{-1}$) to CO₂ equivalents using the formula: $CO_2\ (kg\ yr^{-1}) = Mg\ C\ ha^{-1}\ yr^{-1} \times Area\ (ha) \times 1,000 \times 3.67$, where 1,000 converts megagrams to kilograms and 3.67 is the molecular weight ratio of CO₂ to carbon.

b. Air Quality Regulation (Climate Mitigation Service)

- Air quality trends were assessed as an indicative and indirect ecosystem service, reflecting the broader contribution of increased urban green cover to atmospheric regulation rather than a direct, stand-alone impact attributable solely to the plantation intervention. This approach recognises the complex and multi-factor nature of urban air quality dynamics.
- A comparative assessment of monthly average Air Quality Index (AQI) values between 2022 and 2024 at nearby monitoring locations indicates an overall improvement in air quality across 9 out of 12 months during the assessment period. Notably, the most pronounced reductions were observed during the winter months, particularly in November and December, when particulate matter concentrations typically peak due to stagnant atmospheric conditions and increased regional emissions.
- The observed seasonal improvements are consistent with the established functions of dense, maturing vegetation, including interception and deposition of airborne particulates, suppression of re-suspended dust, and enhanced atmospheric filtering as canopy density and leaf surface area increase. These functions are particularly relevant during dry and winter periods, when vegetation can moderate near-surface pollutant accumulation.
- A plot illustrating the monthly AQI reduction trends is provided below to visualise temporal patterns and seasonal variability, supporting interpretation of the results without implying direct causality.

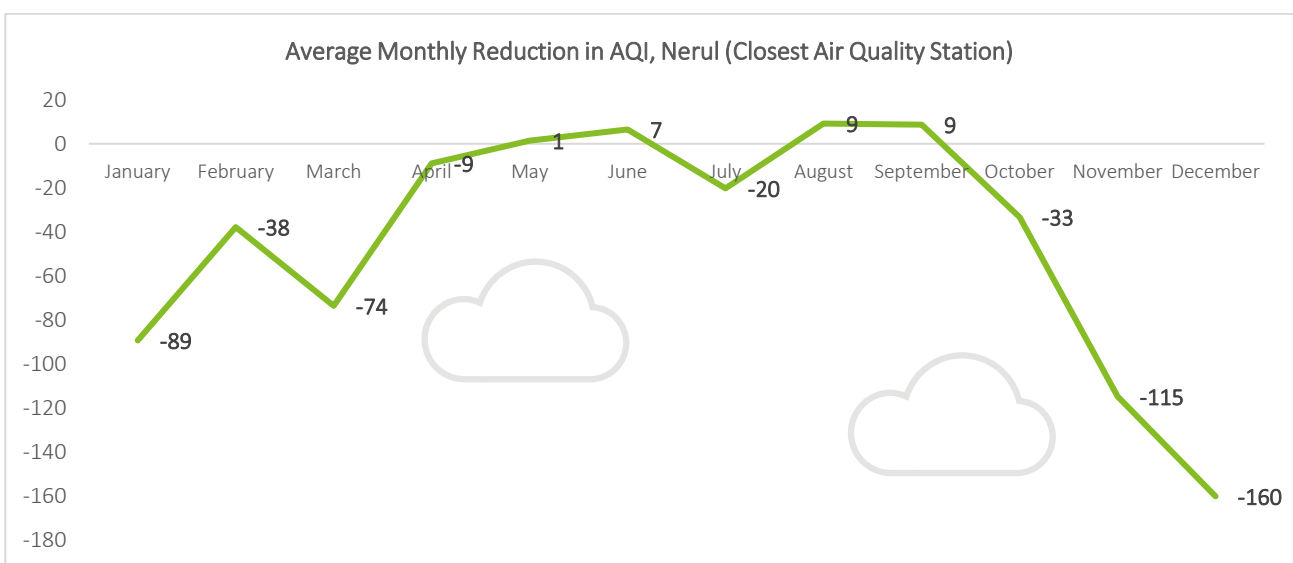
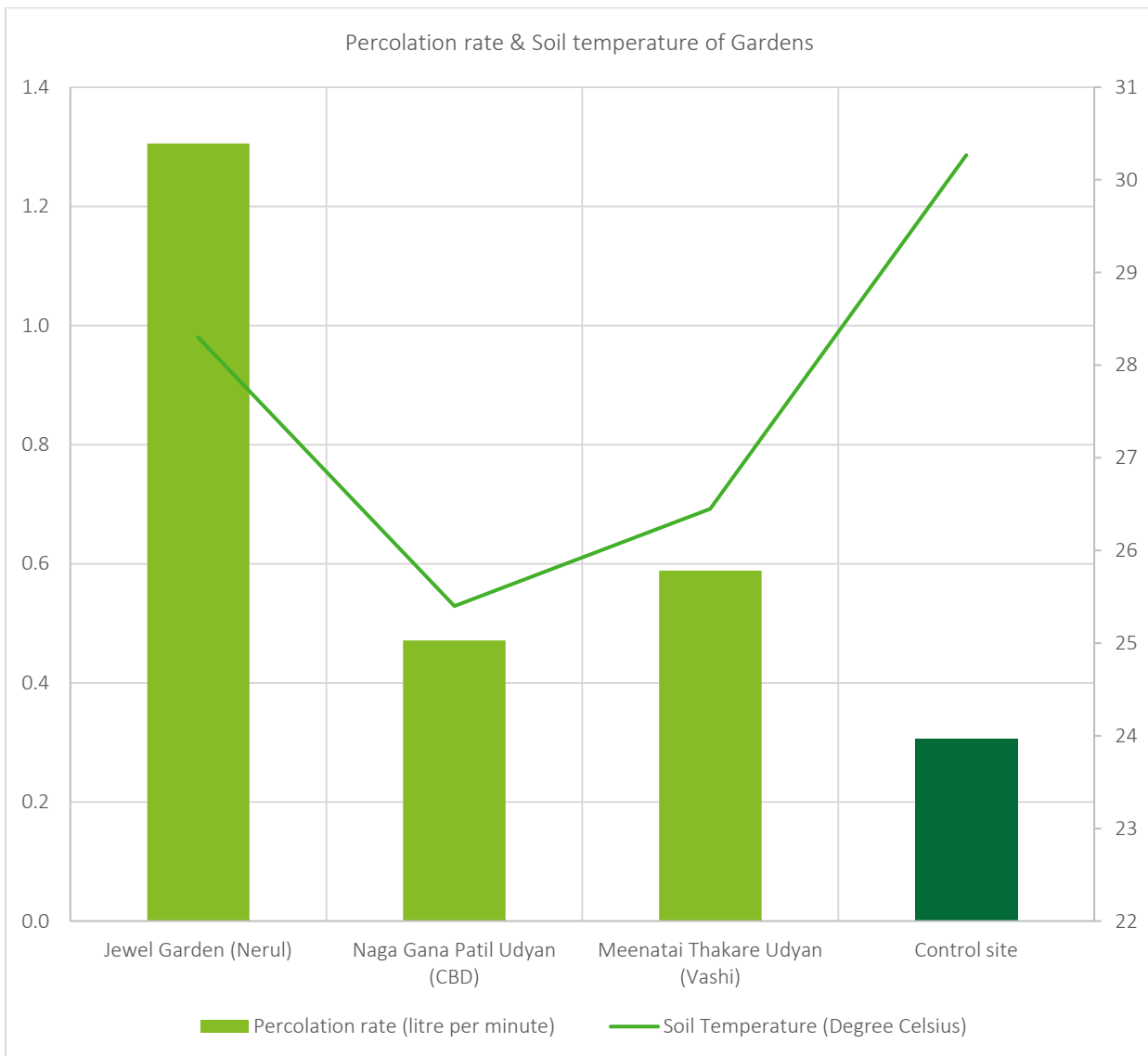


Figure 6: AQI Change (Source: Daily AQI, Nerul Navi Mumbai MPCB)

c. Temperature regulation & Infiltration rate

- Field-based measurements indicate that Miyawaki plantation sites exhibited substantially enhanced hydrological and microclimatic performance when compared to a control plot. Percolation rates at plantation sites were observed to be approximately 2–4 times higher than the control, with the highest infiltration recorded at Jewel Garden (1.3 L/min). These elevated infiltration rates reflect improved soil structure resulting from dense root networks, organic matter accumulation and reduced surface compaction, all of which facilitate groundwater recharge and reduce surface runoff.
- In parallel, soil temperatures across plantation plots were consistently 3–5°C lower than the control site, indicating effective ground shading, reduced heat absorption and localised microclimate stabilisation. Together, these observations signify the role of dense, multi-layered plantations in enhancing urban resilience, particularly through improved water regulation, thermal buffering and heat stress mitigation.
- The control site was established within Meenatai Thakare Udyan (Vashi), located inside the same park system and selected to ensure broadly comparable baseline conditions. The control plot exhibited similar soil texture, moisture levels and overall soil outlook, but was managed under a conventional tree plantation configuration, allowing for a relative comparison of plantation models rather than site characteristics alone.



4. Testimonials & Case studies



A community veteran

The place is good and rare to find in Navi Mumbai/Mumbai. I have seen this place since 2009. The footfall has improved in Jewel Garden. Earlier, some parts were nurseries, now these have turned into fully grown forest space with varieties of green plantation. The government has to build and maintain but the public is equally responsible.



A couple from the community

I have been coming here since 10 years. I have noticed a lot of plantation, and also experienced the change in temperature. Good environment created, would love to be part of volunteering and plantation drives.



A young community member

This is a nice park. My father has been coming here regularly and also recommended it to me. Would be great if there is more awareness through boards etc.

Mr. Pradeep Tripathi, Founder, Green Yatra

Our collaborations and works are focused on urban settings. These Miyawaki plantations contain native species and, also help reduce pollution. We have undertaken multiple forest surveys to choose the local species.

We are open to have an awareness component as a part of projects, as we regularly undertake awareness sessions. We also plan to make our biodiversity studies public for community consumption.





A community member, Jewel of Navi Mumbai

The individual is a football coach and was previously a national football player. He has been visiting Jewel Garden since last 2-3 years and brings children from his coaching academy to practice at the garden.

While he did not notice the plantation taking place, he did notice the change after the plantation was completed. He expressed that it is a good, spacious place to play and do recreational activities and is surrounded with plants and greenery. He observed that people of all age groups visited the garden.



While expressing partial willingness in participating in plant drives, he felt that both the public and local body could be equal stakeholders in the maintenance of the garden, sharing its responsibility.



5. Way forward

5.1 Gaps & Recommendation

The project reviewed by Deloitte outlined certain opportunity areas to enhance the effectiveness of the grant and maximize impact. These are presented as project wise recommendations in the table below:

Program Aspect/s	Gaps Identified	Recommendations
Planning and Development	<ul style="list-style-type: none"> Documentation on species adaptation analysis pertaining to local forests or ecosystem was missing Opportunities to enhance ecosystem integrity and connectivity are identified and incorporated into the NbS strategy (species and layer wise survival mapping) 	<ul style="list-style-type: none"> To improve establishment and balance survival across all forest strata, a more detailed Potential Natural Vegetation (PNV) analysis could be undertaken and the same may be documented as a part of project completion report. While most species included in the plantation are native to Maharashtra and occur naturally within the Konkan biogeographic region, a limited number represent dry-deciduous, ornamental, or cultivated species with restricted or non-native occurrence in the Konkan. This highlights the importance of site-specific Potential Natural Vegetation (PNV) analysis to further refine species selection for Konkan landscapes. Therefore, documentation and reasoning regarding the same is critical part of planning process. This further tells that Miyawaki forest plantation has two critical steps as iterated above and it varies based on the biogeographic region which shall be taken in account for future interventions in any other geography. As no species wise tagging was done, the survivability of local native and native species and different layers of plantation under Miyawaki could not be informed well. The IP may be strictly recommended to maintain the process of tagging species and layer type in any such future interventions for smooth mapping and assessing diverse impacts and adaptability. Given the observed variation in establishment across vegetation layers, future plantation cycles could recalibrate layer-wise composition by strengthening PNV and may consider ground layer (e.g., native mosses, fungi) to reduce below-canopy competition and improve soil microclimate, while prioritizing shade-tolerant shrub species and removing one of the layers (sub-trees or sub-canopy). This adaptive refinement will help balance inter-layer competition, support natural regeneration, and enhance long-term ecological stability of the plantation. Maintain clear database on plots as GIS layers for efficient long-term monitoring of the area.
Target Alignment	<ul style="list-style-type: none"> Regular monitoring in place or benchmarking of keystones targets needed 	<ul style="list-style-type: none"> In order to inform the design, monitoring and assessment of an NbS, targets for enhancing key biodiversity values could be established. For each NbS, the type of target may differ. For example, the target could be the percentage of ecosystem area restored, return of a keystone species, air quality improvement and temperature reduction in close vicinity.
Reporting & Documentation	<ul style="list-style-type: none"> Formal documents and letters unavailable 	<ul style="list-style-type: none"> Formal documentation from permission to undertake lands held by local institution to handover letter or any other support to be maintained. Further documentation on biodiversity of the plantation sites is underway by the Green Yatra Trust which would further add value in understanding the floral and faunal related gains or richness.

		<ul style="list-style-type: none"> Absence of invasive species must be documented via a species checklist validated against regional biodiversity databases or Forest Department norms.
Awareness & Volunteering	<ul style="list-style-type: none"> Low awareness in the community Need for holistic engagement or picture of Miyawaki plantation 	<ul style="list-style-type: none"> Future volunteering activities could be broadened to include a more holistic participation experience, such as Potential Natural Vegetation (PNV) exercises, species selection workshops, and quadrat surveys rather than putting complete focus on plantation sites. Green Yatra Trust already engages in awareness programs of greening initiatives. For future program models, mobilizing local community, nearby schools or colleges with educational components such as guided forest walks and plant knowledge sessions would be smoother. This can foster deeper community connection and understanding of the Miyawaki method.
Integrate Conservation with Sustainable Livelihood	<ul style="list-style-type: none"> Opportunity to explore alternative green livelihood models 	<ul style="list-style-type: none"> Green Yatra trust can explore income generation activities like composting development and apiculture as additional incentives for the maintenance staff.
Establish a Scientific Monitoring & Impact Measurement System	<ul style="list-style-type: none"> Long-term monitoring and pioneering Opportunity to deploy low-cost technology 	<ul style="list-style-type: none"> As the plantation requires long-term monitoring, funder may explore expert led resource for long-term stage wise impact of such initiatives for understanding varying geography and its inter-relation with the model adopted. Deploy low-cost IoT-based sensors in intervened areas to measure air quality improvements and micro-climatic changes. Such a setup would allow scientific attribution of climate regulation services (air quality and thermal regulation) to the plantation and provide data for future impact assessments, decision making, and SDG/NbS reporting. Engage citizen science groups and local universities for species mapping (birds, insects, plants, reptiles etc.).
Carbon Sequestration	<ul style="list-style-type: none"> Choice of plantation models 	<ul style="list-style-type: none"> As carbon sequestration in Miyawaki plantations is observed to stabilize after approximately 15 to 20 years, a mixed plantation strategy is recommended to sustain long-term carbon accumulation. Integrating Miyawaki-style dense native plantations for rapid early-stage sequestration with conventional or low-density native plantations that continue to grow and sequester carbon over multiple decades can optimize both short- and long-term carbon sink potential.
Sustainability	<ul style="list-style-type: none"> Opportunity to forward plan and streamline future lake restoration efforts Feedback loop 	<ul style="list-style-type: none"> To ensure effective governance, the IP may define and establish fully agreed upon feedback and grievance resolution mechanism and make sure it is available to all stakeholders before an NbS intervention is initiated and all stakeholder consultations from planning to execution could be recorded for supporting the (FPIC) Free, Prior and Informed Consent rights. Post-plantation or at closure, recreational assessment (e.g., community usage surveys or safety audits) could help ensure continued social-ecological balance. Green Yatra Trust could develop a pre-implementation project report with landscaping plan and as GIS layers that includes all interventions; location wise detailed information be it of any plantation patch or restoration activity. Have formal agreements with local community or authority for maintaining the long-term sustainability of activities.

5.2 Opportunity Areas

Program Aspect/s	Opportunity
Upscaling and Management	<ul style="list-style-type: none"> • Large-scale plantation commitments strictly emphasize the need for robust planning by employing spatial tools as well as field-based evidence on the survival, carbon sequestration and ecological performance of different plantation models. • With a clear long-term vision and defined goals, such commitments can demonstrate how context-specific plantation designs respond to diverse ecological and socio-spatial conditions, while informing policy discourse with shared decision making, municipal planning and future corporate climate investments.
ESG Goal Aligned Monitoring & Impact System	<ul style="list-style-type: none"> • The initiative presents a strong opportunity for the funder to pioneer long-term, evidence-driven afforestation models in urban and peri-urban India. • Sustained, stage-wise monitoring beyond the initial maintenance period would support a deeper understanding of how plantation models perform across varying geographies, soil conditions, hydrological settings and urban forms. • By strategically focusing on parks, gardens and other publicly accessible spaces across both urban and rural areas, there is scope to develop nationwide scalable insights and measure impact over time.
Awareness & Volunteering	<ul style="list-style-type: none"> • Future volunteering initiatives can be expanded beyond planting activities to offer more immersive and educational engagement. • This may include Potential Natural Vegetation (PNV) mapping exercises, species selection workshops and basic ecological surveys, enabling participants to better understand the science behind plantation design. • Building on the implementing partner's existing awareness programmes and interest expressed by the visiting community members; greater involvement of local communities, schools and colleges through guided forest walks and plant knowledge sessions can further strengthen public connection to the Miyawaki method and foster long-term stewardship.

6. Annexures

6.1 Indicator Mapping

Criterion	Indicator / Metric	Mapped Criterion	Framework
1	City/State/National goal alignment (NMSH, SDGs)	Relevance or societal challenges (Criterion 1)	NbS
1	Policy linkage (e.g. MSAAPC)	Relevance or societal challenges (Criterion 1)	NbS
2	Soil suitability	Design at scale	NbS
2	Watering mechanisms (wastewater, groundwater)	Design at scale	NbS
3	Biodiversity impact (plant-based)	Biodiversity Net Gain	NbS
3	No. of species introduced	Biodiversity Net Gain (Criterion 3)	NbS + RBM
4	Cost per surviving sapling	Economic Viability (Criterion 4)	NbS
5	No. of volunteering activities	Social Equity (Criterion 5)	NbS
6	Community acceptance / recreation unaffected	Balance of Trade-offs	NbS
6	Land used: degraded / brownfield sites	Balance of Trade-offs (Criterion 6)	NbS
6	No high-maintenance/invasive species used	Balance of Trade-offs	NbS
7	% Survival Rate	Adaptive Management	NbS + RBM
7	Mid-term learning and feedback adjustment	Adaptive Management	NbS
7	No. of native/local/native-non-native species	Coherence (Criterion 7)	NbS + RBM
7	Species selection and SOP adherence	Adaptive Management (Criterion 7)	NbS
7	Survival by species type (recommended)	Adaptive Management	NbS
7	Use of municipal parks (NMMC-owned)	Coherence	NbS
7	Biomass (girth assessment for analysing layers)	Adaptive Management (Criterion 7)	NbS + RBM
8	Community or institutional ownership	Sustainability	NbS
8	Maintenance plan included	Sustainability (Criterion 8)	NbS
9	Air Quality Index	Ecological services (impact)	NbS+RBM
9	Average plant height (Growth rate)	Ecological services (impact)	RBM
9	Carbon sequestration	Ecological services (impact)	NbS+RBM
9	Soil moisture (sensor data)	Ecological services (impact)	NbS
9	Soil temperature (sensor data)	Ecological services (impact)	NbS+RBM
9	Water percolation rate (field tested)	Ecological services (impact)	NbS+RBM

6.2 All sites plantation list

Sr. No.	Scientific Name	Common Name	Hindi / Marathi Name	Layer Type
1	<i>Azanza lampas</i>	Ban kapas	Jangli bhindi	Shrub
2	<i>Carissa carandas</i>	Bengal currant	Karonda	Shrub
3	<i>Citrus limon</i>	Lemon	Nimbu	Sub-tree
4	<i>Jasminum multiflorum</i>	Indian/Star jasmine	Kunda	Shrub
5	<i>Justicia adhatoda</i>	Malabar nut	Adulsa	Shrub
6	<i>Murraya koenigii</i>	Curry leaf tree	Kari patta	Sub-tree
7	<i>Nerium oleander</i>	Oleander	Kaner	Sub-tree
8	<i>Tabernaemontana divaricata</i>	Crape jasmine	Chandni	Sub-tree
9	<i>Vitex negundo</i>	Five-leaved Chaste Tree	Nirgundi	Shrub
10	<i>Acacia catechu</i>	Cutch tree	Khair	Canopy
11	<i>Aegle marmelos</i>	Bael	Bel	Sub-canopy
12	<i>Azadirachta indica</i>	Neem	Neem	Canopy
13	<i>Bauhinia racemosa</i>	Bidi leaf tree	Kanchan	Sub-canopy
14	<i>Bauhinia variegata</i>	Kachnar	Kanchanar	Sub-canopy
15	<i>Butea monosperma</i>	Palash	Palash	Sub-canopy
16	<i>Cordia dichotoma</i>	Indian cherry	Lasora	Sub-canopy
17	<i>Erythrina suberosa</i>	Coral tree	Pangara	Sub-canopy
18	<i>Ficus glomerata</i>	Gular	Umar	Canopy
19	<i>Holarrhena antidysenterica</i>	Kurchi	Kudha	Sub-tree
20	<i>Lagerstroemia parviflora</i>	Small crape myrtle	Dhaura	Sub-canopy
21	<i>Memecylon edule</i>	Ironwood	Anjan	Sub-tree
22	<i>Murraya paniculata</i>	Orange jasmine	Kamini	Shrub
23	<i>Nyctanthes arbor-tristis</i>	Parijat	Shefali	Shrub
24	<i>Oroxylum indicum</i>	Indian trumpet tree	Tetu	Canopy
25	<i>Phyllanthus emblica</i>	Amla	Amla	Sub-canopy
26	<i>Pterocarpus santalinus</i>	Red sanders	Rakt chandan	Canopy
27	<i>Saraca asoca</i>	Ashoka	Sita Asoka	Canopy
28	<i>Terminalia catappa</i>	Indian almond	Badam	Sub-canopy
29	<i>Ziziphus mauritiana</i>	Jujube	Ber	Sub-tree
30	<i>Artocarpus heterophyllus</i>	Jackfruit	Kathal	Canopy
31	<i>Careya arborea</i>	Wild guava	Kumbhi	Sub-tree
32	<i>Cassia fistula</i>	Golden shower	Amaltas	Canopy
33	<i>Dalbergia sissoo</i>	Shisham	Shisham	Canopy
34	<i>Erythrina variegata</i>	Indian coral tree	Pangara	Canopy
35	<i>Garcinia indica</i>	Kokum	Kokam	Canopy
36	<i>Holoptelea integrifolia</i>	Indian elm	Chilbil	Canopy
37	<i>Lagerstroemia speciosa</i>	Jarul	Jarul	Sub-canopy
38	<i>Madhuca longifolia</i>	Mahua	Mahua	Canopy
39	<i>Manilkara hexandra</i>	Khirni	Khirni	Canopy
40	<i>Mimusops elengi</i>	Bakul	Bakul	Sub-canopy
41	<i>Pongamia pinnata</i>	Karanj	Karanj	Sub-canopy
42	<i>Sapindus mukorossi</i>	Soapnut	Reetha	Sub-tree
43	<i>Semecarpus anacardium</i>	Marking nut	Bhilawan	Sub-tree
44	<i>Syzygium cumini</i>	Jamun	Jamun	Canopy
45	<i>Terminalia arjuna</i>	Arjun	Arjun	Sub-canopy
46	<i>Terminalia elliptica</i>	Asan	Asan	Sub-canopy

47	<i>Albizia lebeck</i>	Siris	Shirish	Canopy
48	<i>Bombax ceiba</i>	Semal	Semal	Canopy
49	<i>Ficus benghalensis</i>	Banyan	Vad	Canopy
50	<i>Ficus religiosa</i>	Peepal	Pipal	Canopy
51	<i>Gmelina arborea</i>	Gmelina	Shivan	Sub-canopy
52	<i>Magnolia champaca</i>	Champak	Son Champa	Sub-canopy
53	<i>Mangifera indica</i>	Mango	Aam	Canopy
54	<i>Neolamarckia cadamba</i>	Kadamb	Kadamb	Canopy
55	<i>Tectona grandis</i>	Teak	Sagwan	Canopy
56	<i>Terminalia bellirica</i>	Bahera	Bahera	Canopy

6.3 Biodiversity of Plantation Sites

Jewel Garden:



Figure 7: Biodiversity observed at Jewel Garden (Source: Green Yatra Trust)

Species	Botanical Name	Ecological Function
Blue Banded Bee	<i>Amegilla cingulata</i>	Pollination
Blue Tiger	<i>Tirumala limniace</i>	Pollination, prey species
Solitary Wasp	<i>Sceliphron</i> sp.	Insect population control
Lesser Flamingo (Nearly Threatened)	<i>Phoenicopterus minor</i>	Wetland nutrient cycling (Migratory)
Common Lime	<i>Papilio demoleus</i>	Pollination
Russell's Viper (Protected - Yes (WPA Sch II))	<i>Daboia russelii</i>	Rodent population control
Oriental Garden Lizard	<i>Calotes versicolor</i>	Insect population regulation
Indian Pond Heron	<i>Ardeola grayii</i>	Wetland foraging, trophic balance
Baya Weaver Bird	<i>Ploceus philippinus</i>	Seed dispersal
Common Mynah	<i>Acridotheres tristis</i>	Omnivory, pest control
Rock Pigeon	<i>Columba livia</i>	Seed dispersal
House Sparrow	<i>Passer domesticus</i>	Insect & seed regulation
House Crow	<i>Corvus splendens</i>	Scavenging
White-breasted Waterhen	<i>Amaurornis phoenicurus</i>	Wetland trophic balance
Geometer Moth	Family <i>Geometridae</i>	Prey species

Naga Gana Park:

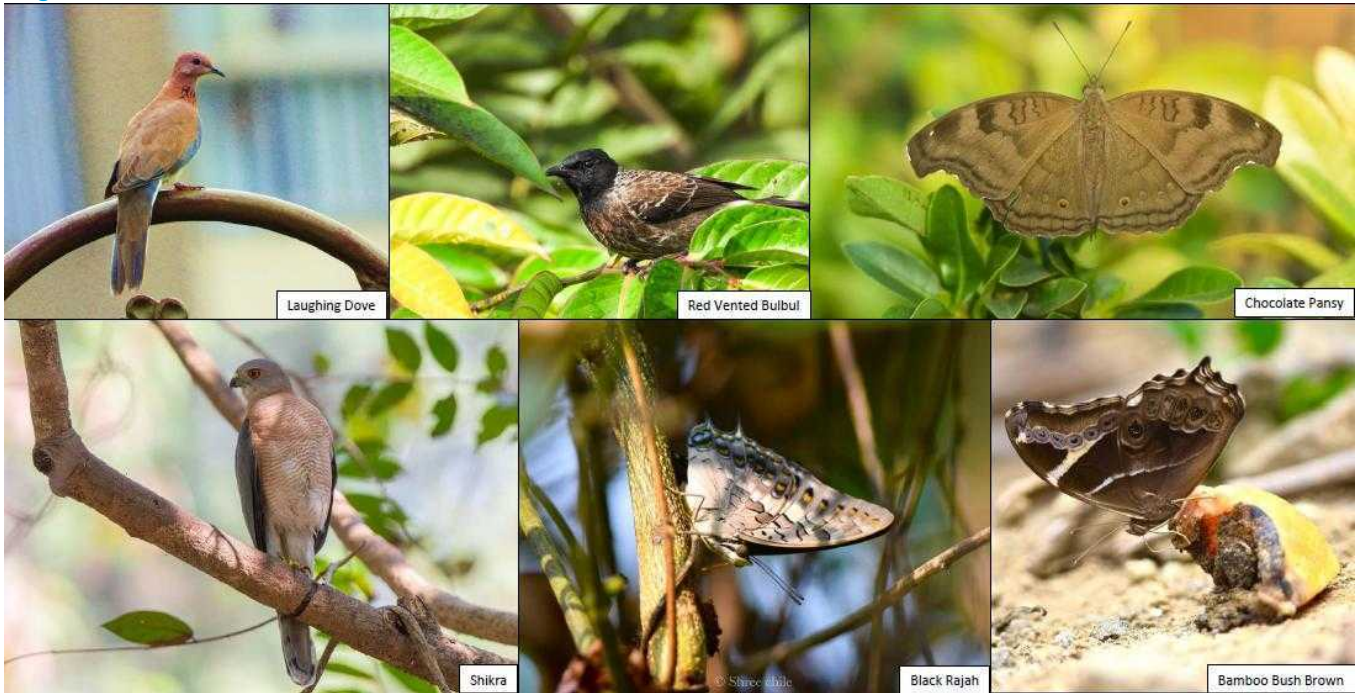


Figure 8: Biodiversity at Naga Gana Park (Source: Green Yatra Trust)

Species	Botanical Name	Ecological Function
Laughing Dove	<i>Spilopelia senegalensis</i>	Seed dispersal
Red-vented Bulbul	<i>Pycnonotus cafer</i>	Seed dispersal
Chocolate Pansy	<i>Junonia iphita</i>	Pollination
Shikra	<i>Accipiter badius</i>	Mesopredator regulation
Black Rajah	<i>Charaxes solon</i>	Pollination
Bamboo Bush Brown	<i>Mycalesis perseus</i>	Pollination

Meenatai Thakare Garden:



Figure 9: Biodiversity at Meenatai Thakare (Source: Green Yatra Trust)

Species	Botanical Name	Ecological Function
Green Bee-eater	<i>Merops orientalis</i>	Insect population control
Black Drongo	<i>Dicrurus macrocercus</i>	Insect population control
Scarlet Skimmer	<i>Crocothemis servilia</i>	Mosquito control
Black Redstart (Migratory)	<i>Phoenicurus ochruros</i>	Insect regulation
Purple Sunbird	<i>Cinnyris asiaticus</i>	Pollination
Tawny Coster	<i>Acraea violae</i>	Pollination
Cattle Egret	<i>Bubulcus ibis</i>	Insect regulation

6.4 Photographical outlook of sites (Before & After)²³

Jewel Garden:



Before



Before



After



After

Naga Gana Park:



Before



Before



After



After

²³ Source: Green Yatra Trust

Meenatai Thakare Garden:



Before



Before



After



After

6.5 Pictures from field



Figure 10: Outlook of Miyawaki plantation at Naga Gana Park



Figure 11: Outlook of conventional plantation at the entrance of Meenatai Thakare Garden

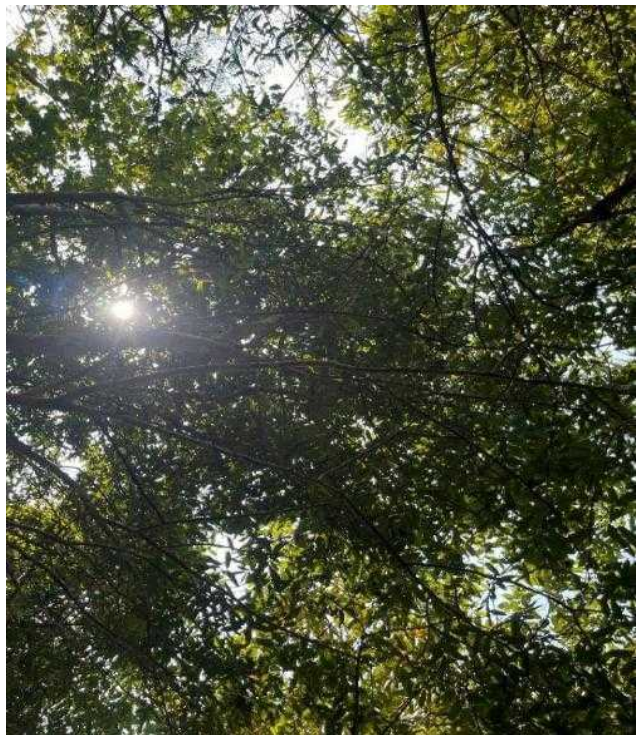


Figure 12: View of sunlight entering at Miyawaki site in Jewel Garden



Figure 13: Water systems connection at Miyawaki site in Jewel Garden



Figure 14: Jewel Garden information board on Miyawaki Plantation



Figure 15: Naga Gana information board on Miyawaki Plantation



Figure 16: Meenatai Thakare Garden information board on Miyawaki Plantation

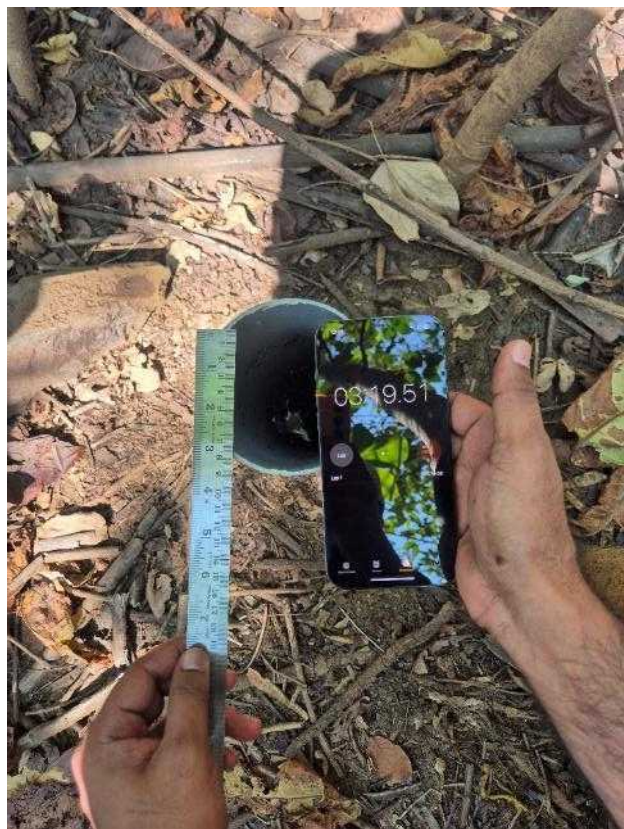


Figure 17: Field assessment for percolation rate



Figure 18: Percolation test at Naga Gana Miyawaki site



Figure 19: Plant girth assessments at site



Figure 20: Stakeholder interaction with the implementing partner



Figure 21: Interaction with community members

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