



Social Impact Assessment (SIA) Study for Miyawaki Plantation and its Ecological Impact

Year: 2023-24

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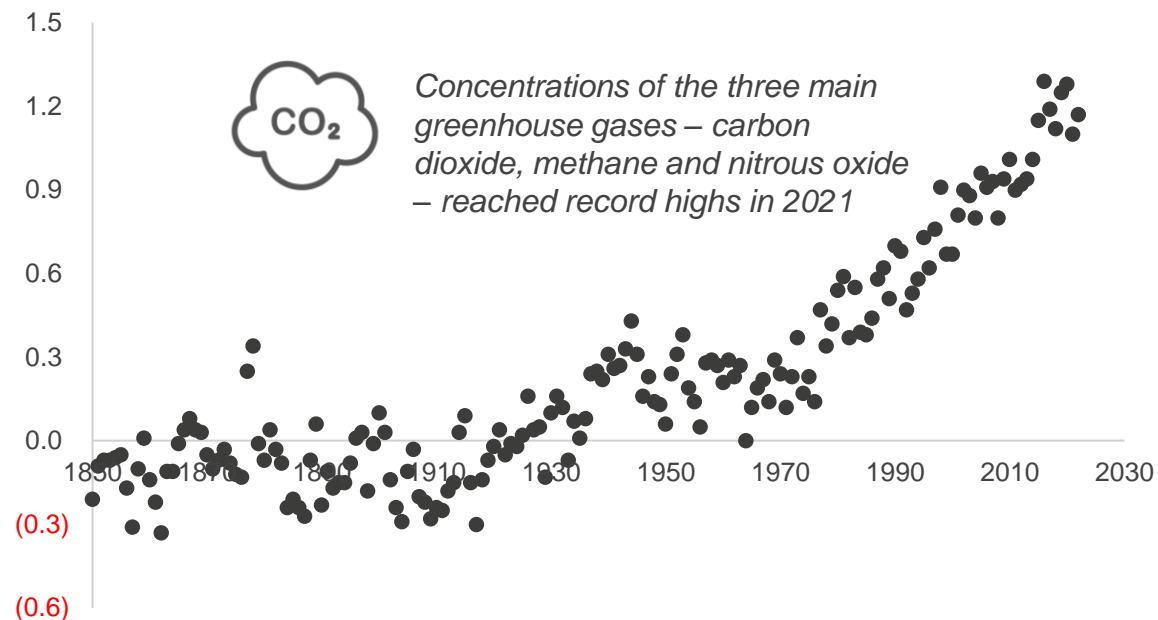
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- ❖ As per the **WEF Global Risk Report 2023**, the **top four risks** over the coming decade, in terms of likelihood, are all **Climate-related**, **both in terms of adaptation and mitigation**
- ❖ The latest Intergovernmental Panel on Climate Change report finds that global temperature is already 1.1 °C above pre-industrial levels and is likely to reach or surpass the critical 1.5°C tipping point by 2035¹.
- ❖ There is a **48%** chance the annual mean global temperature will temporarily exceed 1.5 °C above pre-industrial levels (1850-1900) for at least one of the next five years (2022–2026)
- ❖ The increased frequency and intensity of natural disasters and disease outbreaks, owing to climate change outcomes, will have an adverse effect, primarily on the rural economy

Global annual mean temperature relative to pre-industrial levels



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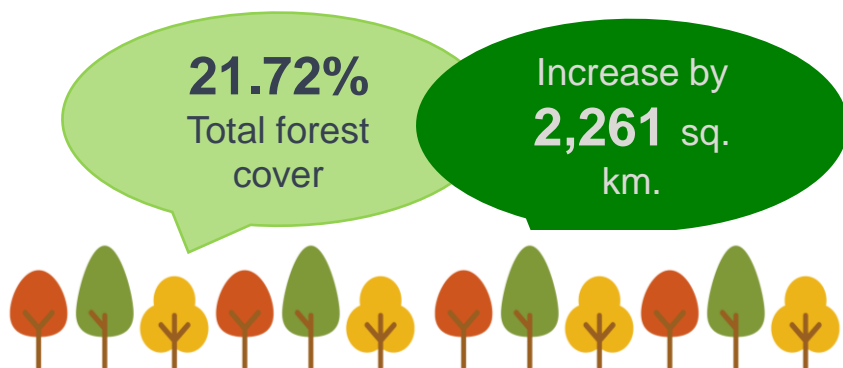
Following are the events that took place around the globe during 2022

- ❑ China had the most extensive and long-lasting heatwave since national records began
- ❑ Temperatures reached 40 °C in the United Kingdom for the first time
- ❑ The Mediterranean region experienced major heatwaves
- ❑ Drought intensified in the Greater Horn of Africa region
- ❑ Europe also experienced numerous heatwaves

Impact of climate change in India

- ❖ The Indian Monsoon onset was earlier, and the withdrawal was later than normal in 2022
- ❖ The pre-monsoon period was exceptionally hot in India
- ❖ Heatwaves in the 2022 pre-monsoon season in India caused a decline in crop yields
- ❖ By June 2022, monsoon season flooding triggered 663,000 displacements in Assam

Positive changes in India



- ❑ Afforestation activities taken up under various programs and schemes of line Ministry and under schemes of State Government/UT Administration through different departments, Non-Government Organizations, Civil Society, Corporate bodies etc. The multi-departmental efforts have yielded good results in conserving and enhancing forest cover in the country

One of the way to mitigate climate change and restore the lost tree cover in a short time in resource-depleted communities

- ❑ India recognizes challenges owing to climate change and is taking steps to mitigate and adapt to climate change
- ❑ The country has set ambitious renewable energy targets, promotes afforestation, and participates in international climate agreements like the Paris Agreement to reduce greenhouse gas emissions. However, the complex interplay between climate change and India's development aspirations remains a critical issue for the nation to address
- ❑ As per India's first nationally determined contribution working towards climate justice, India is to create an additional carbon sink of 2.5-3.0 billion tonnes of CO2 equivalent through additional forest and tree cover by 2030
- ❑ Miyawaki Plantation – A plantation technique is one of the ways to create a forest cover 10 times faster than the regular forest
- ❑ The technique also helps reduce soil erosion, improve air quality and biodiversity in the region

- ❖ The Project Prakruti program by L&T Finance is a notable initiative promoting environmental sustainability through the maintenance and upkeep of the tree plantations. This initiative has focused on ecosystem restoration, drought-proofing and climate resilience
- ❖ The region was selected as it falls under semi arid region. And small holding of lands in the region has led to further deforestation
- ❖ The combined forest cover for Beed, Osmanabad and Latur has degrown compared to 2019 census¹
- ❖ As an effort to improve the tree cover through trees outside forest, LTFS joined hands with “MArathwada NAVnirman LOKayat” (Manavlok).
- ❖ Manavlok is a non-profit organization working for the betterment of less privileged people with a new idea or an experiment in integrated rural development with a focus on the central part of Maharashtra.
- ❖ Manavlok across three villages (Bhavthana, Salegaon and Pisegaon) across five plots admeasuring 22,000 sq. mt. between January – March 2022 planted 68,444 trees of different species in consultation with the forest department
- ❖ The Crisil team has done the study of the Miyawaki plantation and its impact on air, soil and surroundings and the same is mentioned in the following slides



Source: 1: India state of forest report 2021

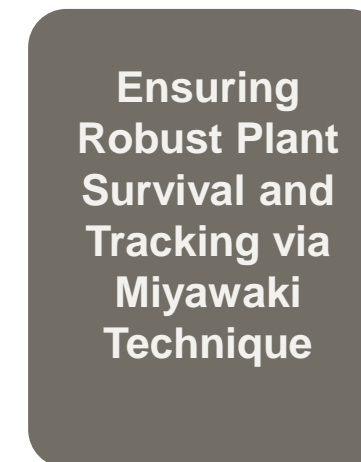
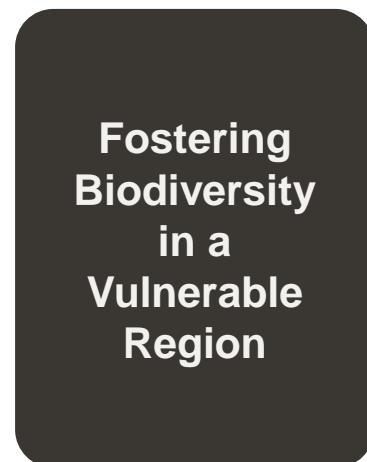
Understanding Miyawaki Plantation

- ❖ The Miyawaki technique, developed by Japanese botanist Akira Miyawaki, has gained popularity as an afforestation method aimed at creating dense, self-sustaining forests in a short period. Studies conducted on Miyawaki plantations have underscored their faster growth rates when compared to traditional afforestation techniques.
- ❖ The combination of a dense planting pattern and a diverse assortment of indigenous species creates a competitive ecosystem that facilitates swift growth and early canopy coverage. This rapid development of a dense canopy is beneficial as it efficiently captures sunlight, thus encouraging further growth and delivering early ecosystem benefits.
- ❖ The dense structure of Miyawaki forests fosters numerous microenvironments and habitats, accommodating a diverse array of plant and animal life. The inclusion of various indigenous plant species promotes the development of intricate ecological networks, enticing a broader spectrum of wildlife.
- ❖ Miyawaki plantations serve as effective windbreaks, especially in regions with high wind speeds. The dense canopy acts as a natural barrier, reducing the impact of strong winds on the surrounding areas.
- ❖ The abundant vegetation found in Miyawaki forests has a notable impact on the microclimate within and around the plantation. These forests help stabilize temperature variations, mitigate the severity of heatwaves, and establish a more favorable environment for both plant and animal life.
- ❖ The rapid growth and early canopy closure provide an advantage in terms of carbon sequestration and biodiversity restoration.





The primary objectives of the plantation initiative encompassed a multifaceted approach to address key environmental challenges within the drought-prone region.



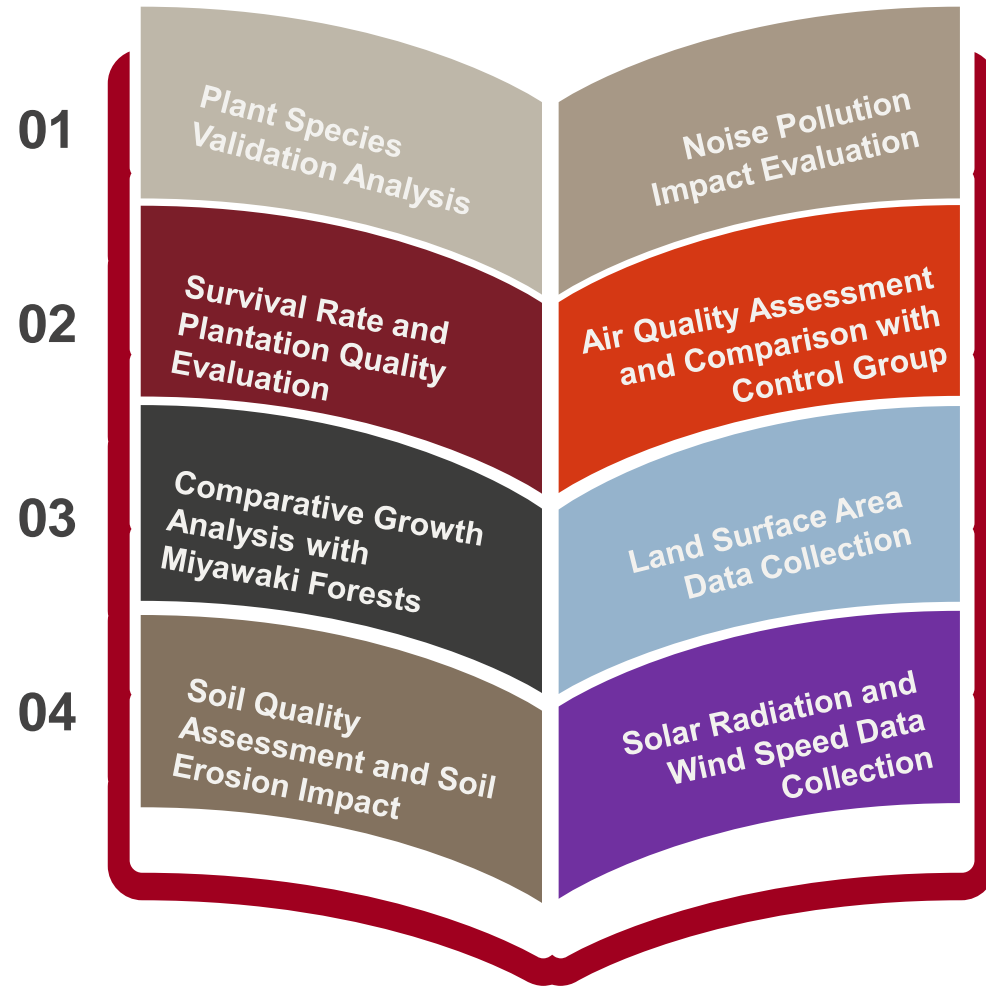
Objectives of the Social Impact Assessment (SIA) Study:

Validating plant species selection in a plantation area by identifying them and assessing their ecological suitability.

Assessing plantation survival and quality through on-ground surveys, aiming to determine successful plant establishment percentages and evaluate vegetation health and growth.

Comparing the growth and development of the plantation with similar Miyawaki forests to assess the chosen technique's effectiveness and identify growth pattern variations, informing future best practices.

This study assesses the plantation's impact on soil quality and erosion by analyzing soil samples to gauge changes in composition and stability, evaluating its effectiveness in preventing erosion and enhancing soil health.



05 This study evaluates the plantation's impact on noise pollution by measuring noise levels in the area, aiming to assess its role in reducing noise and its benefits for the environment and community.

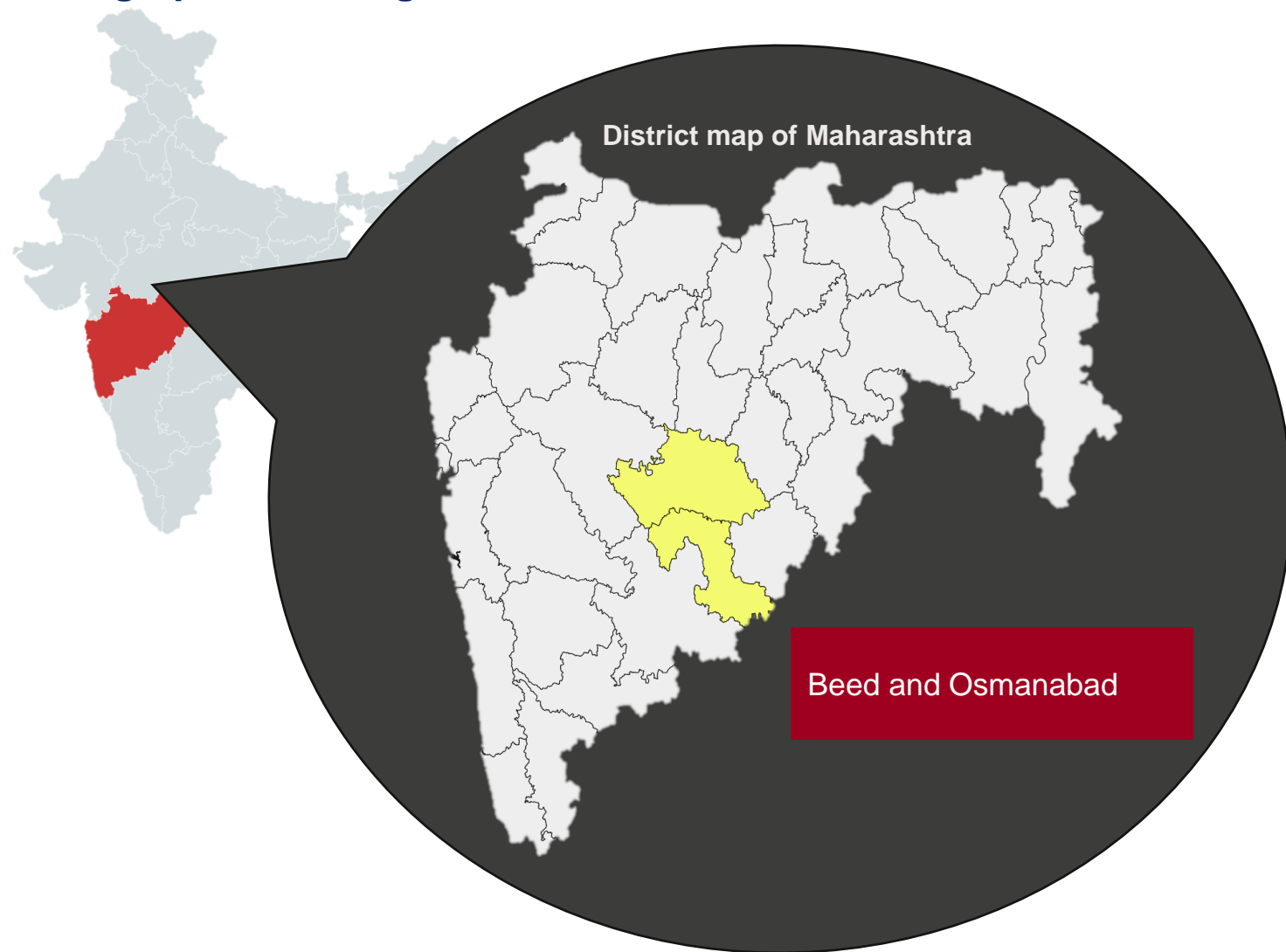
06 This study assesses air quality in and around the impact area, comparing it with a control group. By measuring air quality, it aims to quantify the project's impact on reducing particulate matter (PM) levels and enhancing the surrounding air quality.

07 This study gathers precise land surface area data within the project site, crucial for monitoring, evaluation, and accurate reporting.

08 This study aims to collect current solar radiation and wind speed data to establish a baseline for future monitoring and evaluating the project's environmental impact and effectiveness.

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Geographic Coverage



- L&T Finance through the plantation project plans to target the degraded farm fields or barren lands that can be converted into dense plantations through the Miyawaki technique, which will indirectly help in controlling soil erosion and improving the soil moisture content. The plantation shall be crucial for furthering vegetation and biodiversity in semi-arid regions of Beed and Osmanabad of Maharashtra. Additionally, it is an effort towards drought-proofing and climate resilience
- The intervention partner, Marathwada Navnirman Lokayat (Manavlok), implemented the project at three different locations (Beed and Osmanabad) planting a total of 68,444 trees on a total plot area of 22,000 sq. mt. through the Miyawaki plantation technique
- Under this technique three saplings were planted in 1 sq. mt. area, leading to a dense plantation growth in a stipulated time frame



Findings



Local tree species planted:



- ❖ Tree species evolved in the same ecological community and are well adapted to their environment. The primary reason for planting the local species is the limited care required post establishment, better survival rate, less water requirement, non-invasive, deliver food and habitat to local wildlife
- ❖ Across all three locations (in consultation and as per the list provided by the forest department: 50)
- ❖ **Tree count:** (Extrapolation of sample trees done across all three locations)

Bhavthana	Pisegaon	Salegaon
36,216	10,269	11,896



- ❖ Total number of trees and shrubs as per data shared by Manavlok is 68,444 (64,684 trees + 3,760 shrubs) planted on 22,000 square meter area. As per our estimation total plantation area is 26,949 square meters. However, this area also include the pathways and spaces left for other utilization. Plantation area marked using the mobile-based GIS tool is nearly 20% larger than the planation area as informed by Manavlok

Survival rate:

- ❖ The survival rate is the number of trees that survived post-plantation. The trees' survival depends on multiple factors including soil preparation, species suitability, appropriate and timely watering, weeding, proper insect and pest management, etc. The better survival rate also improves the project's economics by keeping the planting cost low.
- ❖ Total trees calculated by extrapolation coming out to be 58,381 which is 9.70% less than reported. A survival rate of 90.30% is estimated from the above calculations (excluding shrubs).



Actual site photo

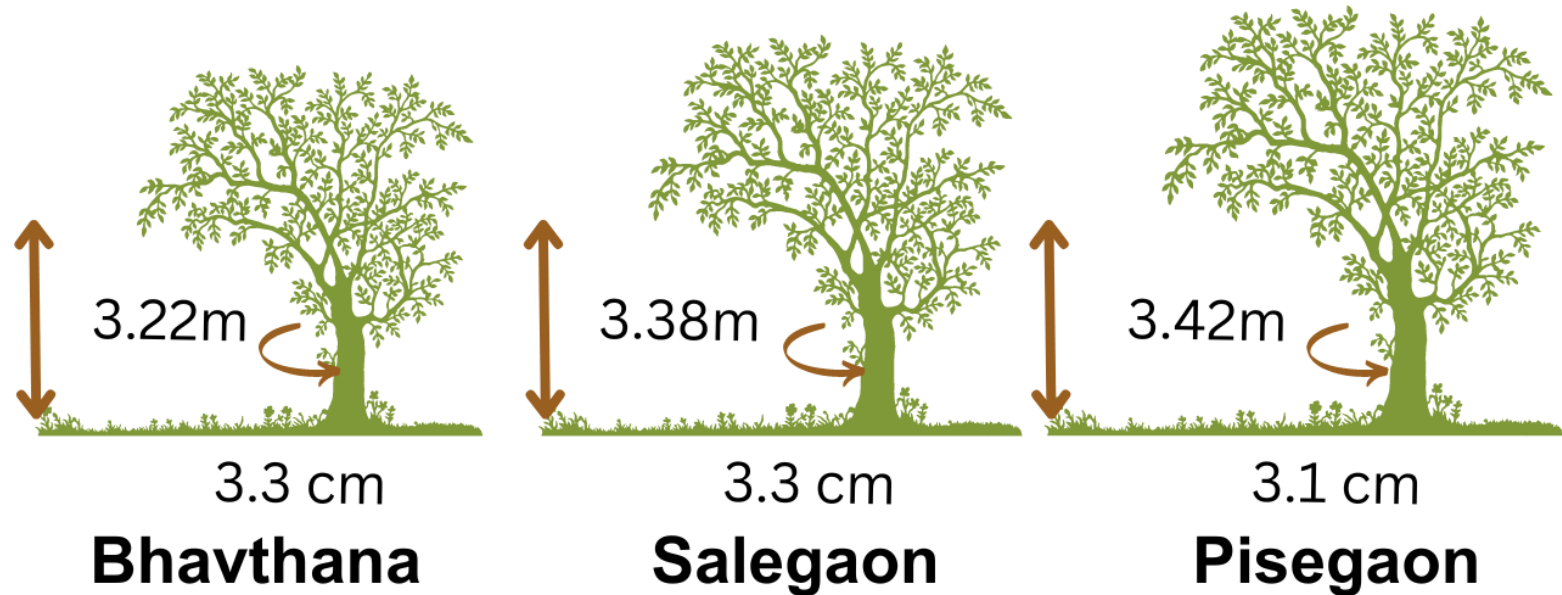
- ❖ The tree cover of the plantation currently stands at 98% as compared to less than 3% cover at most of the sites except Salegaon where the tree cover was around 13%
- ❖ The density of plants in per ha is nearly 21,500 as per extrapolation and GIS area marking. This is a very high-density plantation.
- ❖ Plant growth in all the project site is very fast. As the age of saplings were nearly 8 to 12 months, the age of the plants in the project is nearly 24 to 28 months. The height that these trees have gained within this limited time is phenomenal.
- ❖ Plantation is very dense and have reduced visibility to nearly 3-5 meters at eye level in all the sites.
- ❖ Across all three sites the average diameter of trees stand at 3.2 cm and the average height is about 3.28 meters

Project site	Average diameter of the trees (in cm)	Average height of trees (in meters)
Bhavthana	3.3	3.22
Salegaon	3.3	3.38
Pisegaon	3.1	3.42

Plantation growth compared to similar Miyawaki forest:

Comparative data with similar agroclimatic condition for any Miyawaki plantation is not available so comparison is done between three sites:

- ❖ Bhavthana has a mean diameter of roughly 3.3 centimeters and an average height of approximately 3.22 meters.
- ❖ Pisegaon has a slightly smaller mean diameter of around 3.1 centimeters but compensates with a taller average height of about 3.42 meters.
- ❖ Salegaon boasts the highest average diameter among the three sites, at approximately 3.3 centimeters, while maintaining a mean height of roughly 3.38 meters.
- ❖ When considering the combined data for all sites, the average diameter is approximately 3.2 centimeters, and the average height is about 3.28 meters.

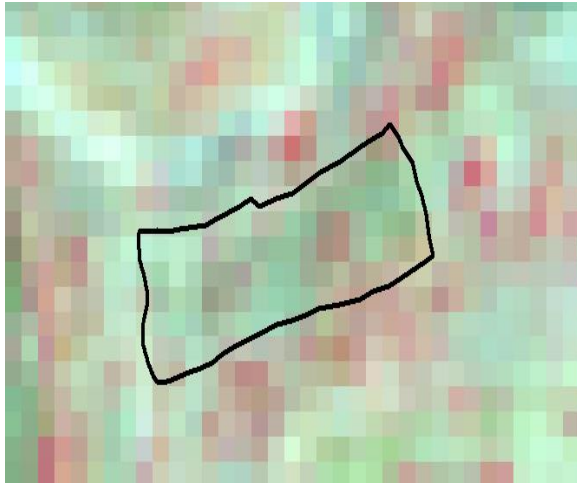


- ❖ This analysis suggests that while there are slight variations in both diameter and height among the sites, the differences are not substantial.
- ❖ Bhavthana, Pisegaon, and Salegaon all demonstrate relatively similar plant growth patterns in terms of these measurements.
- ❖ However, it's important to note that other factors, such as soil composition, climate conditions, and specific plant species, could contribute to these growth patterns.

Pre and Post Satellite Imaging of Sites: False Colour Composite (FCC)

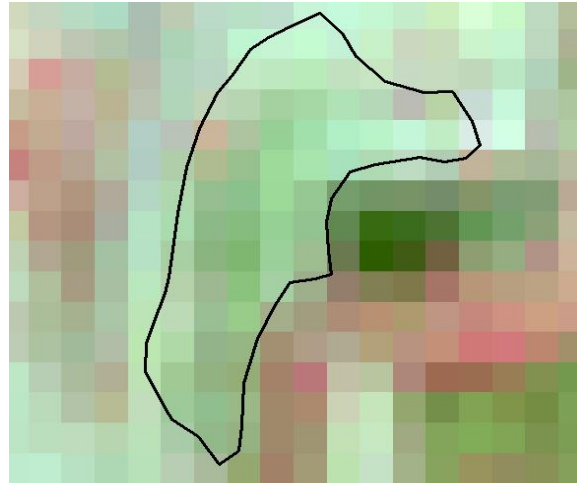
Pre - Plantation Satellite Images: May 26, 2020

Bhavthana – F1 Plot
Latitude - 76°28'41.42"E
Longitude: 76°17'41.49"E



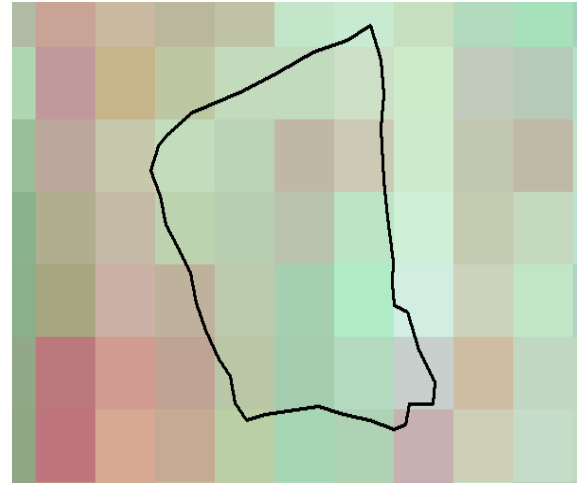
Bhavthana – F1 Plot

Bhavthana – F1 Plot
Latitude - 76°28'41.42"E
Longitude: 76°17'41.49"E



Bhavthana – F2 Plot

Bhavthana – F1 Plot
Latitude - 76°28'41.42"E
Longitude: 76°17'41.49"E



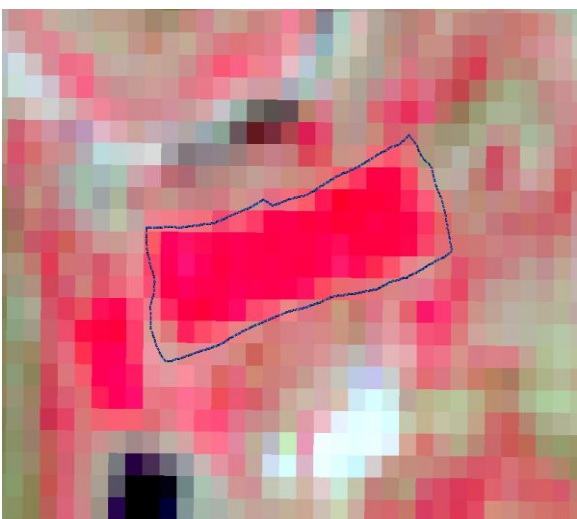
Bhavthana – F3 Plot

Salegaon – F1 Plot
Latitude - 17°56'6.66"N
Longitude: 76°28'41.42"E

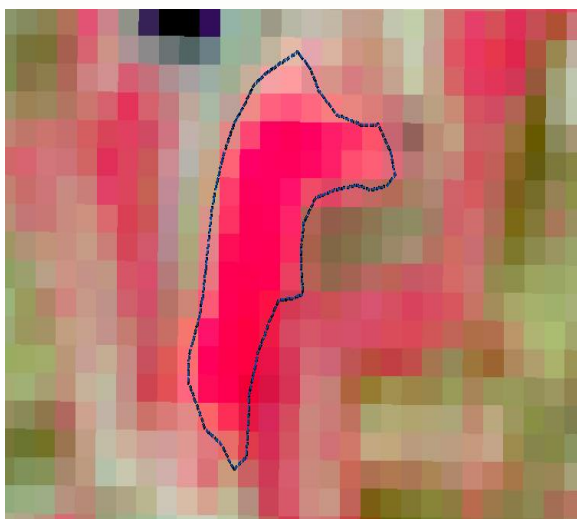


Salegaon – F1 Plot

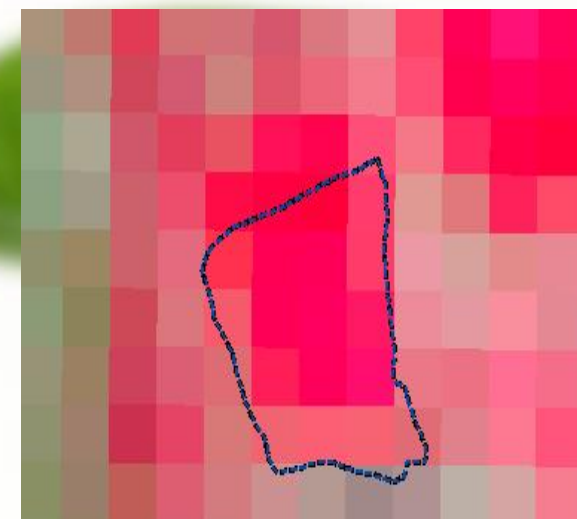
Post Plantation Satellite Images: May 26, 2023



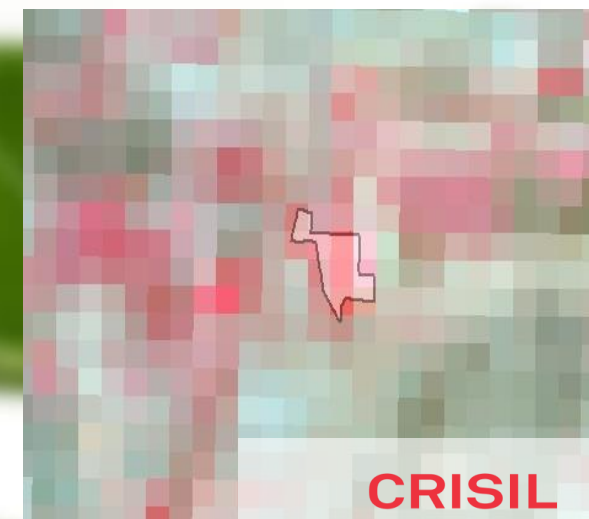
Bhavthana – F1 Plot



Bhavthana – F2 Plot



Bhavthana – F3 Plot



Salegaon – F1 Plot

The red and light pink colour reflects vegetation / tree cover area under FCC. FCC images are used as the RGB satellite images were unavailable of the said locations vegetation/tree

Pre and Post Satellite Imaging of Sites:

Pre – Plantation Satellite Images: May 26, 2020

Pisegaon – F1 Plot
 Latitude - 18°42'48.03"N
 Longitude: 76° 5'49.58"E



Pisegaon – F2 Plot
 Latitude - 18°42'48.03"N
 Longitude: 76° 5'49.58"E



Pisegaon – F12 Plot
 Latitude - 18°42'48.03"N
 Longitude: 76° 5'49.58"E



Pisegaon – F1 Plot

Pisegaon – F2 Plot

Pisegaon – F12 Plot

Post Plantation Satellite Images: May 26, 2023





Soil Quality Assessment and Impact on Soil Erosion:

Soil quality assessment is done by soil testing in Krishi Vigyan Kendra(KVK) lab. Multiple soil samples are taken from each of project location and a representative mix would be created. The soil was dried to require moisture level and sent to KVK for testing. Test results would be analyzed and compared with standards (guidelines).

Plantation provide vital services in terms of rainfall moderation and erosion control through mechanisms such as canopy interception, root reinforcement, and soil moisture regulation.



Air Pollution:

Air quality of both project sites as well as control location is of very good quality

**The study was conducted during rainy season and in general air quality improves significantly due to it. This is one of the reason that all parameters fall in very good air quality range. Apart from this only one location (Pisegaon) is near to source of any pollution(Road). All other locations have enough distance from population and a busy road, this is another reason for having good air quality in project as well as control site*

Threshold (µm)	Bhavthana		Pisegaon		Salegaon		
	Project	Control	Project	Control	Project	Control	
HCHO	0.1	0.02	0.02	0.02	0.01	0.01	
PM 2.5	75	6	8	8	5	4	
PM 1	10	5	6	6	3	3	
PM 10	40	7	9	9	5	4	
TVOC	0.50	0.01	0.01	0.01	0.00	0.01	
APL		2.57	2.58	2.89	2.67	1.67	1.50

Findings on Noise Pollution and Solar Radiation:

Noise pollution:

Noise pollution data shows normal levels both inside the project location and in nearby control locations as the projects are far away from nearby population areas and traffic.

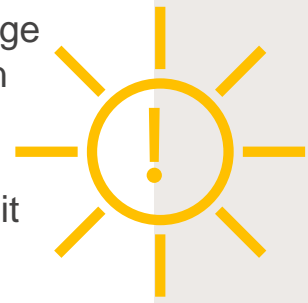


The windy situation creates more noise inside the plantation than the outside in the control location where there are fewer plants/trees.

Control	63	71	72
(in decibel)	58	70	73
Project	Bhavthana	Pisegaon	Salegaon

Solar radiation:

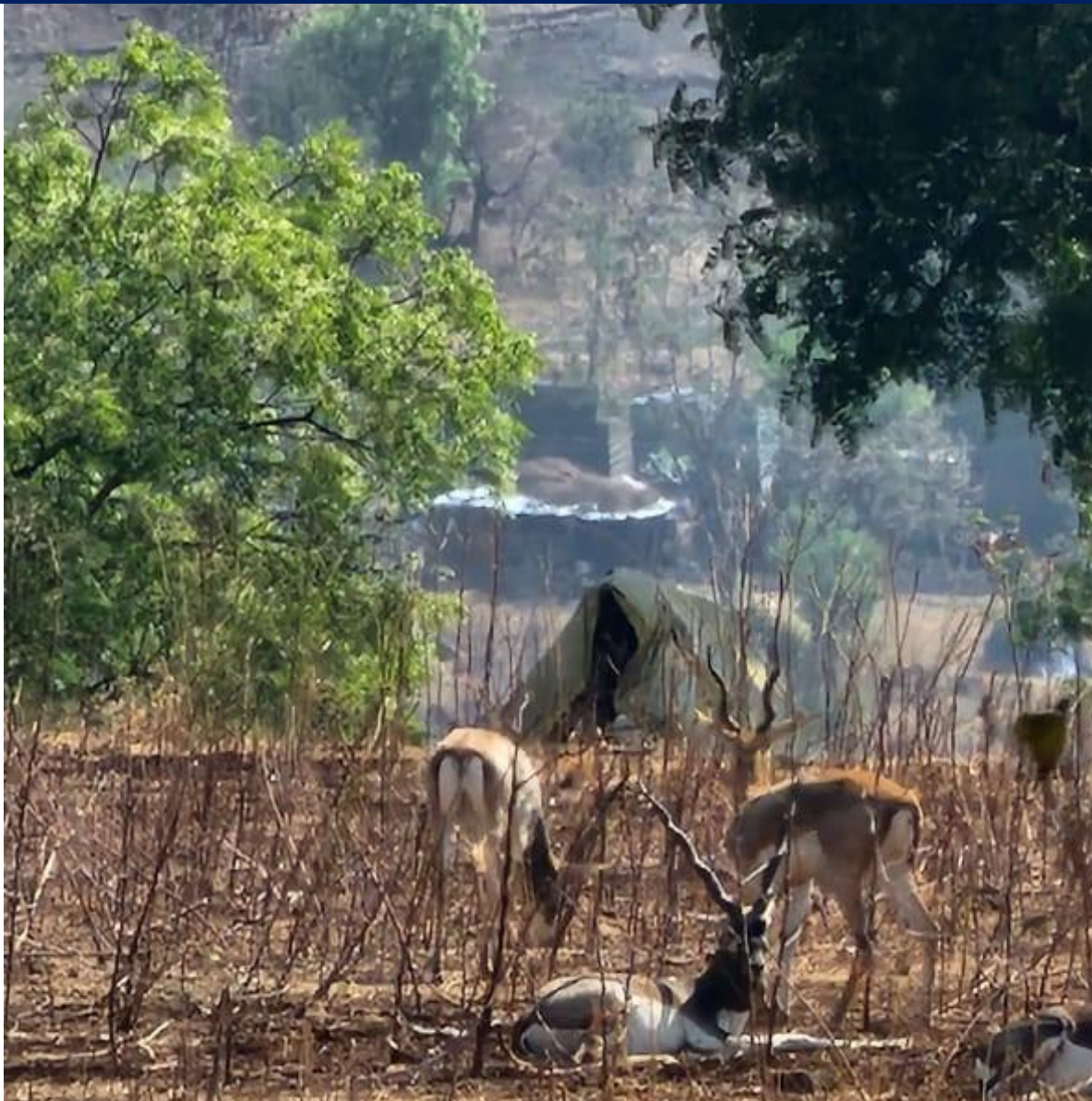
As can be seen the canopy cover has reduced the light intensity in the project site to a large extent. As the reading represents average of three readings, the difference is more during the daytime when the light intensity reduces significantly inside the plantation.



The solar radiation data is important for the fact that absence of it promotes plant height growth due to competition. The average growth of tree heights in the project is much higher than any normal plantation.

Control	1387	1657	1081
(in lumens)	949	1254	954
Project	Bhavthana	Pisegaon	Salegaon

Change in Ecological Environment due to Miyawaki Plantation:



- ❖ The plantation experienced competitive growth so dense that sunshine is not reaching the ground by end of the first year. Every drop of water is saved at this stage, and every leaf that falls is decomposed. The more the plantation expands, the more nutrients it produces for itself, allowing it to expand even faster allowing even faster tree growth. The quick growth and density of the plantation leads to develop more carbon pools in plant biomass and life in the soil.
- ❖ The plantation cannot replace true forest but is helping restore biodiversity and help fight climate change's impact. The method accelerates growth and carbon storage compared to forests regenerating without any human intervention.
- ❖ The plantation has led to the collaboration of living creatures both complex and peculiar — microbes, fungi, shrubs, ground- covers. In turn, this clustering attracts insects, birds, and animals in an interdependent manner. The insects help in the pollination process.
- ❖ A key principle of Miyawaki plantation is the use of native plant species. Native plants are those naturally occurring in a specific region and have adapted to local soil, climate, and ecological conditions over time.
- ❖ Miyawaki plantation is helpful in reconstructing degraded natural habitats and native plant environments. The plantation lowers temperature and supports local biodiversity including micro and macro flora and fauna.

Animals (Deer) were spotted recently at one of the Miyawaki plantation

Change in Ecological Environment due to Miyawaki Plantation:

❖ The plantation effort has accomplished a remarkable transformation, taking what was once a degraded and barren land area and turning it into a thriving and intricately woven ecosystem. This transformation can be characterized as a complex and interconnected network of both biotic (living) and abiotic (non-living) elements

❖ **Native Flora:** The introduction of native plant species has reintroduced a diverse array of vegetation to the area. These plants, ranging from trees to shrubs and ground cover, contribute to the overall biodiversity of the ecosystem. They provide habitat and sustenance for a variety of wildlife, from insects and birds to small mammals and amphibians.

❖ **Wildlife:** The plantation (flora) has attracted the fauna in the region. The discussion with the locals and the caretakers clearly indicates the plantation has become the habitat and peacocks, mongoose, partridge, wild boar, porcupine, sparrows, butterflies, grasshoppers, snakes and many other birds (avifauna), bees and insects (microfauna) are regularly spotted in and around the plantation.

❖ **Microorganisms:** Beneath the soil, a bustling community of microorganisms, including bacteria, fungi, and other soil-dwelling organisms, play a crucial role in nutrient cycling and soil health. Their presence and activities are integral to the success of the plantation and the overall ecosystem.

The photos of birds, animals and insects in the current slide are not from the actual site



Peacock



Mongoose



Rabbit



Deer



Wild boar



Porcupine



Sparrow



Partridge



Butterfly



Grasshopper



Snake



Honey bees

Change in Ecological Environment due to Miyawaki Plantation:

- ❖ The plantation is helping build the required environmental balance in the ecosystem through CO2 sequestration and ensuring overall well-being in the surrounding areas
- ❖ The plantation has grown quickly, and this rapid growth has had the effect of reducing local temperatures. As the plants mature, they provide shade and release moisture through a process called transpiration, which cools the surrounding area. This temperature drop can have several positive effects, including making the environment more hospitable for both plants and animals.
- ❖ The positive changes brought about by the plantation contribute to the overall improvement of the local ecology. A healthier ecosystem includes a greater diversity of plant and animal species, improved nutrient cycling, and a more stable and resilient environment.
- ❖ The presence of the plantation has contributed to the enrichment of the soil. As the plants shed leaves, twigs, and other organic material, it decomposes and adds nutrients to the soil. This improved soil quality can support healthier plant growth and overall ecosystem vitality.
- ❖ This bio-diverse native plantation reduces the runoff and absorbs rainwater leading to water retention and ground water recharge. The growth in plantations in the region is expected to reduce dependency on water tankers in the near future.



- ❖ The forest department had been a great support for such activity due to their knowledge about the plantation technique and its past experience in the region.
- ❖ As per the discussion with the forest department team, the first Miyawaki plantation that they had worked on and got first-hand knowledge about was in 2017.
- ❖ For better survival of the plantation, they are planted at the onset of the rains. Planting trees at the onset of the rainy season is a strategic and environmentally conscious approach that offers numerous benefits, not only for the survival of the plantation but also for long-term ecological sustainability. This timing aligns with the natural rhythms of the environment and has a positive impact on both plant health and water resource management
- ❖ Planting during the rainy season provides a consistent and readily available source of water for the young trees. Rainfall during this time can naturally water the plants, reducing the need for artificial irrigation. This results in a higher survival rate, as the trees are less vulnerable to drought stress and dehydration during their critical early growth stages.
- ❖ At some locations, some water bodies are also constructed so the water can be stored and utilized during the winter and summer seasons.
- ❖ The forest department is willing to help the private landowners with the plant species knowledge and the ways plantation can be done other than that the forest department does not provide any other help.
- ❖ While interacting the forest department team also confirmed that the department also extends LPG subsidy schemes in the nearby forest region, so the villagers don't destroy the forest and cut the trees for their firewood purpose



- ❖ The dedicated caretakers stationed at various locations have a longstanding association with Manavlok that predates the implementation of the plantation intervention.
- ❖ Their journey with Manavlok has been one of continuous growth and development, resulting in a remarkable transformation in their roles and responsibilities. Through a series of initiatives and support mechanisms, Manavlok has nurtured their expertise in various domains, including plantation management, agriculture, water resource management, disaster preparedness, and more.
 - **Comprehensive Training and Field Exposure:** Manavlok's commitment to capacity building is evident in its investment in caretakers' knowledge and skills. Over the years, these caretakers have benefited from multiple training sessions and extensive field visits.
 - **Emerging as experts:** Thanks to their exposure and continuous learning opportunities, these caretakers have evolved into experts in their respective fields. Whether it's understanding the intricacies of native plant species, implementing sustainable agricultural practices, managing water resources efficiently, or preparing communities for disaster situations, they have developed a profound level of expertise.
 - **Ownership and Responsibility:** The caretakers' journey from novices to experts has resulted in a strong sense of ownership and responsibility towards Manavlok's projects. They now oversee these initiatives with a heightened level of authority and dedication. Their deep-rooted knowledge enables them to guide and mentor others, contributing to the overall success of Manavlok's endeavors.



Way Forward:

- ❖ The presence of a dense canopy within the forest plays a vital role in shaping the ecosystem and has several significant effects on the environment. One of the key impacts is the shading of the forest floor, which leads to a reduction in undergrowth and the decomposition of dead organic matter. This process has important implications, particularly in the context of carbon preservation and the overall health of the forest ecosystem.
- ❖ It is important to note that there comes a stage of inflection when the carbon stored in tree biomass (both above ground and below ground) becomes less than the carbon stored in the soil.
- ❖ The plantation is expected to provide a cooling effect in the surrounding areas through evapotranspiration.



Evapotranspiration combines two vital processes in the plant-soil-atmosphere system: "evaporation" and "transpiration." Evaporation involves the conversion of liquid water (usually from soil, bodies of water, or plant surfaces) into water vapor when exposed to heat. Transpiration, on the other hand, is the release of water vapor from plant leaves and stems during photosynthesis and respiration.

- ❖ The plantation with its increased coverage will also help in the production of food and shelter as well as safe haven to the fauna in the region.
- ❖ The plantation is expected to be more responsive to climate changes and able to achieve better biome in near future



Actual photo of the site



“A nation that destroys its soils destroys itself. Forests are the lungs of our land, purifying the air and giving fresh strength to our people.” — Franklin D. Roosevelt

Thank You

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