REFORESTATION OF TALOJA HILL WATERSHED THROUGH COMMUNITY PARTICIPATION

Location: Taloja Hills, Opposite Hyde Park, Sector 35G, Kharghar, Navi Mumbai 410210

19°4'17.35"N 73°4'7.86"E
Google Map link: Click

Project Duration: April 2022 – March 2023
Project Reporting Period: January 2023 – March 2023
Project Report No. 4

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DCB BANK

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REFORESTATION OF TALOJA WATERSHED THROUGH COMMUNITY PARTICIPATION

Quarterly Report 4 (January to March 2023)

1. PROJECT HIGHLIGHTS

- 2873 saplings including herbs, shrubs and trees are surviving at the site with a survival rate of 52.8%. This includes second year surviving 4021 saplings in March 2022 and 1414 saplings planted as compensatory plantation in June-Sep 2022.
- The total number of species sighted at site has increased from 309 to 395 (comparison of March 2022 - 2023). The total plant species has increased from 143 to 172, insect species has increased from 63 to 100 and arthropod species has increased from 0 to 11, amphibian species has increased from 6 to 7 species, reptile species has increased from 16 to 17 species, bird species has increased from 75 to 78 and mammal species has increased from 6 to 10.
- Saplings in the nursery have grown well. We have collected native seeds from the wild to be sown into sapling bags and grown in nursery. There are 117 saplings growing well in the nursery.
- The carbon sequestration studies found that 129 kg of carbon is stored in 26 tree saplings.
- There has been increased occurrence of termites while they could attack the plants, however their presence suggests increase in soil moisture which is a good thing.
- We conducted volunteering and community awareness programmes and reached out to 602 individuals, including school and college students, corporate employees and community members.

2. SUMMARY

Figure 1: Project Site

2.1 Location: Taloja Hill Watershed is a hill range adjoining the Taloja Lake and Owe dam situated close to Sector 35- G in Kharghar, Navi Mumbai.

- **Address:** Taloja Hills, Opposite Hyde Park, Sector 35G, Kharghar, Navi Mumbai 410210
- **GPS coordinates:** 19°4'17.35"N 73°4'7.86"E

- **Google Map link**: Click

Figure 2: Site map

2.2 Need for undertaking the project:

- **Problem**: The hill was largely denuded with fewer trees and required immediate measures to control soil erosion.
- **Hypothesis**: Afforestation of the barren hill with the help in controlling soil erosion, increase green cover and ground water level and will also help in involving local community participation for conservation.
- **Implementation**: 5000 plant saplings were planted to carry out afforestation of the barren hill. The local community was involved in the plantation activities to increase awareness about the ecological importance of the Hill.
- **Impact**: The green cover has increased due to the plantation. This resulted in increase of biodiversity as well.

2.3. Executive Summary: Under this project iNaturewatch foundation, funded by DCB Bank, reforested 7.3 hectares of the Taloja hill watershed area alongside local community members. The plantation was done at the baren and rocky site of Taloja Hill Watershed, Kharghar, Navi Mumbai. The duration of the project is one year April 2022 to March 2023. However, the plantation had started previously in the year 2020 during the lockdown period where in 1421 saplings were planted at the site. Later 6478 saplings were planted at the hills during the phase 2 of the project April 2021 to March 2022. Out of the total 7902 saplings planted at the site 4021 saplings were surviving in March 2022. Also the biodiversity survey revealed that the site sustains 143 species of plants and 166 species of animals (63 insects, 6 amphibians, 16 reptiles, 75 birds, 6 mammals).

Hence under the current project which is the phase 3, during the period of April 2022 – March 2023 iNaturewatch Foundation intended to take care of the plantation done previously, plant 1001 saplings as compensatory plantation, continue the biodiversity survey, prepare ground through contour bunding and terracing, raise community forest nursery, and conduct stakeholder engagement activities for 860 participants throughout the year. A nature trail will also be developed along with signages for nature education of visitors. This is the phase 3 and last year of the project.

During the first and second quarter of this year of the project 1414 saplings were planted at the site in April–June and July–September 2022 to compensate the mortality. 2887 saplings were surviving during the September 2022 plantation review. Plantation maintenance activities like de-weeding and tree guard repairing was carried out. 129 community and corporate volunteers attended the volunteering and awareness programmes at site.

In the third quarter from October to December 2022 we conducted the biodiversity survey, site maintenance work, plantation review and community engagement programmes. During the fourth quarter from January 2023 to March 2023 we carried out the biodiversity survey, socio economic survey, site maintenance work, and plantation review.

It has been observed that the total number of species sighted at site has increased from 309 to 395 (comparison of March 2022 - 2023). The total plant species has increased from 143 to 172, insect species has increased from 63 to 89 and arthropod species has increased from 0 to 11, amphibian species has increased from 6 to 7 species, reptile species has increased from 16 to 17 species, bird species has increased from 75 to 78 and mammal species has increased from 6 to 10.

The plantation review showed 2873 saplings are surviving at the site with a survival rate of 52.8% and a mortality of 47.2%. This has been due to the harsh weather conditions, constant cattle grazing, forest fires and also infestation of insect pests. In this report we have covered the yearlong project activities.

3. INTRODUCTION

Figure 3: Project site in March

Taloja Hill Watershed is a hill range adjoining the Taloja Lake and Owe dam. It is a watershed zone as it separates the rainwaters flowing to different water bodies including Taloja Lake in near vicinity. It is situated close to Sector 35-G in Kharghar, Navi Mumbai. The land belongs to Panvel Forest Department and the local residents for Sector 35 have been carrying out environmental protection activity for past few years. The forest department is keen that the local community

takes up the initiative of increasing the green cover over the hill. The hill is largely denuded with fewer trees and required immediate measures to control soil erosion and conduct afforestation of the Taloja hill. This will improve the ground water table as well as benefit the neighbouring village as well. Additionally, the afforestation will enhance the biodiversity of the region. iNaturewatch Foundation has taken up the restoration work of this hills in an area of 7.3 hectare by planting saplings and taking care of them. The project is funded by DCB Bank and the works have started from April 2022.

4. PROJECT GOAL: To reforest degraded Taloja Watershed through community participation in Navi Mumbai.

5. PROJECT OBJECTIVES

- To conduct seasonal biodiversity surveys to assess existing biodiversity
- To prepare ground through contour bunding and terracing
- To raise community forest nursery with the help of local communities
- To carry out compensatory plantation of 1001 saplings
- To develop nature trail along with signages for nature education of visitors
- To conduct monthly stakeholder engagement activities for 860 participants
- To review plant survival on quarterly basis for a years

6. PROJECT TIMELINE: The project duration is one year (April 2022 to March 2023) and following is the Table 1 with detailed Activity Calendar for January to March 2023.

Table 1. Activity Calendar for January to March 2023

Sr No	Project activity	Activity description	Timeline
1.	Community engagement	Conducted tree girth measurement volunteering event for 14 college student of Ramniranjan Jhunjhuwala College	30th December 2022
2.	Field Guide to Taloja Hill Forest	Content for the field guide is developed	November-December 2022
3.	Labours employment	Since we was facing issues to retain caretakers at site, Labours were employed for site work for watering	6th January – 9th January 2023
4.	Community survey	The socio economic survey was conducted by Ms. Roshni Tiwari and Ms. Sameera Hindalekar in Ove Village along with Community representative Ms. Jyoti Nadkarni	9th January - 10th January 2023
5.	Community engagement	Volunteering for Clean- up drive, wild-flower seed collection and Tree guard repairing with DCB Bank employee.	13th January 2023
6.	Mulching	Mulching work for plant	12th- 18th January 2023
7.	Invasive species	American mint removal work	18th – 23RD January 2023

8.	Officer employment	Ms. Roshni Tiwari was hired as a Environmental Project Officer for the site.	1st February 2023
9.	Biodiversity survey	The insect survey was conducted by Ms. Roshni Tiwari	2nd February 2023
10.	Watering Plants	Plants watered on site	2nd- 5th February 2023
11.	Naturalist Training Programme	Naturalist Training Programme	4th- 26th February 2023
12.	Biodiversity survey	Dr. Ketki Marthak conducted bird survey	11th February 2023
13.	Biodiversity survey	Dr. V Shubhalaxmi conducted an insect trail for the Naturalist Training Programme, insect survey and site review.	12th February 2023
14.	Video Shooting	Video shooting was done by Ms Seema Murlidharan	12th February 2023
15.	Nursery Developed	Nursery was repaired by new bamboo and green net	16th - 19th February 2023
16.	Watering Plants	Plants watered on site	20th- 24th February 2023
17.	Biodiversity Survey	Plant survey was conducted by Dr. Shreya Bhanap and Ms. Guari Gurav	25th February 2023
18.	Biodiversity Survey	Herpetofauna survey was conducted by Mr. Ved More and Ms. Roma Tripathi	25th February 2023
19.	Naturalist Training Programme	Validatory Function of Naturalist Training Programme	3rd March 2023
20.	Plantation Maintenance	Tree Guard repairing	9th -12th March 2023
21.	Plantation review	Quarterly planation review was conducted by Ms. Roshni Tiwari	8th-13th March 2023
22.	Watering Plants	Plants watered on site	13th -16th March 2023
23.	Plantation Maintenance	Tree Guard repairing	17th – 23rd March 2023
24.	Field Guide	Launched field guide of Taloja at BNHS	24th March 2023

7. PROJECT IMPLEMENTATION STRATEGIES

7.1 Project Timeline: Following is the Table 2 with project timeline

Table 2 Project Timeline

Project Activities	2022-2023				Milestone
	Q1	Q2	Q3	Q4	
Conducting Seasonal Biodiversity Surveys	X	X	X	X	Seasonal biodiversity data is available
Maintenance of Plantation	X	X	X	X	Compensatory plantation done
Maintenance of Irrigation	X	X	X	X	Irrigation mechanism is in place and maintained
Nature trail Development	X	X	X	X	Nature trail is developed
Maintenance of Project site	X	X	X	X	De-weeding, mulching, fire protection is done.
Development of Signages	X				Nature trail signages are installed
Development of Forest Nursery		X			Nursery is developed
Development of Activity stations			X		Activity stations established
Making of Project Video	X		X		Draft video is completed
Community Participation Programmes	X	X	X	X	Corporate employees and local community members are engaged
Project Review Reporting	X	X	X	X	Quarterly reports are submitted

7.2 Project Team

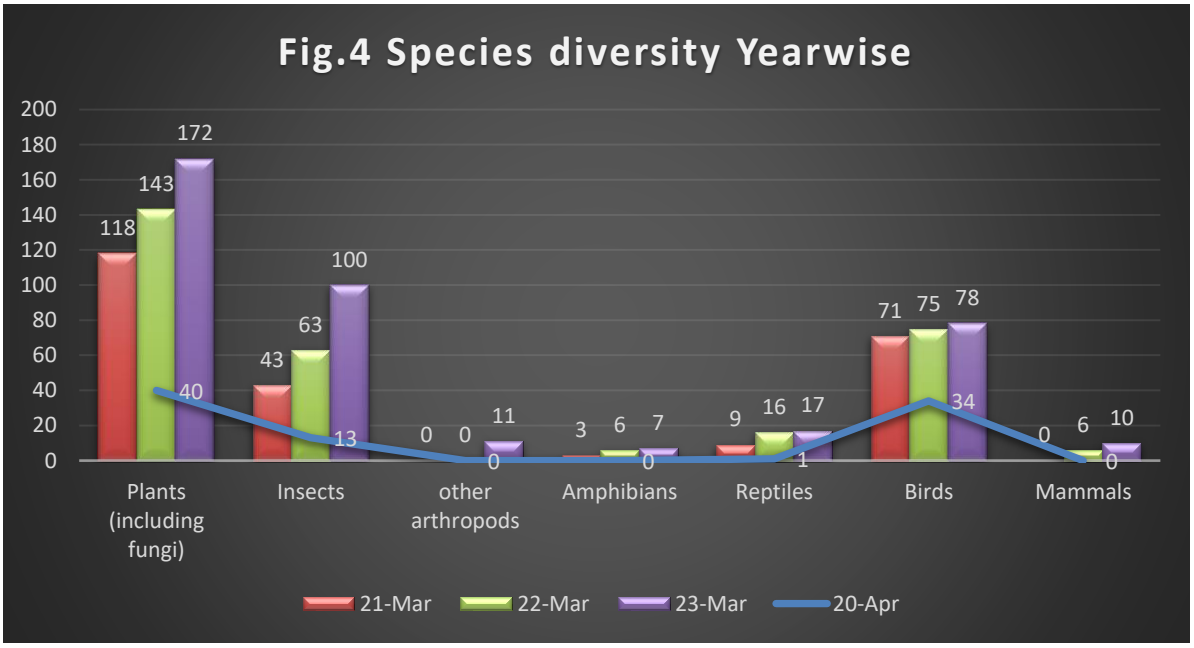
Sr. No	Team Members	Designation
1	Dr. V. Shubhalaxmi	Founder and Managing Trustee & Entomologist
2	Ms. Priti Choghale	Projects Manager
3	Ms. Roshni Tiwari	Project Officer
4	Mr. Isaac Kehimkar	Butterfly Expert & Naturalist
5	Dr. Ketki Marthak	Bird Expert
6	Dr. Shreya Bhanap	Botanist
7	Ms. Gauri Gurav	Botanist
8	Mr. Nishant Umralkar, Programme Officer	Programme Officer
9	Ms. Bharati Desai	Project Officer
10	Ms. Jyoti Nadkarni	Community Representative and Nature Trail expert
11	Prakash Katkari	Site caretaker
12	Anil Katkari	Site caretaker
13	Prakash Bhatose	Ex-Site caretaker
14	Das	Ex-Site caretaker
15	Maruti	Ex-Site caretaker
16	Ashok	Ex-Site caretaker
17	Balu	Ex-Site caretaker

Mr. Prakash Katkari and Anil Katkari were appointed as caretakers from 11th January 2023. Ms. Sameera Hindalekar helped as intern with the socio economic survey done in the neighbouring villages.

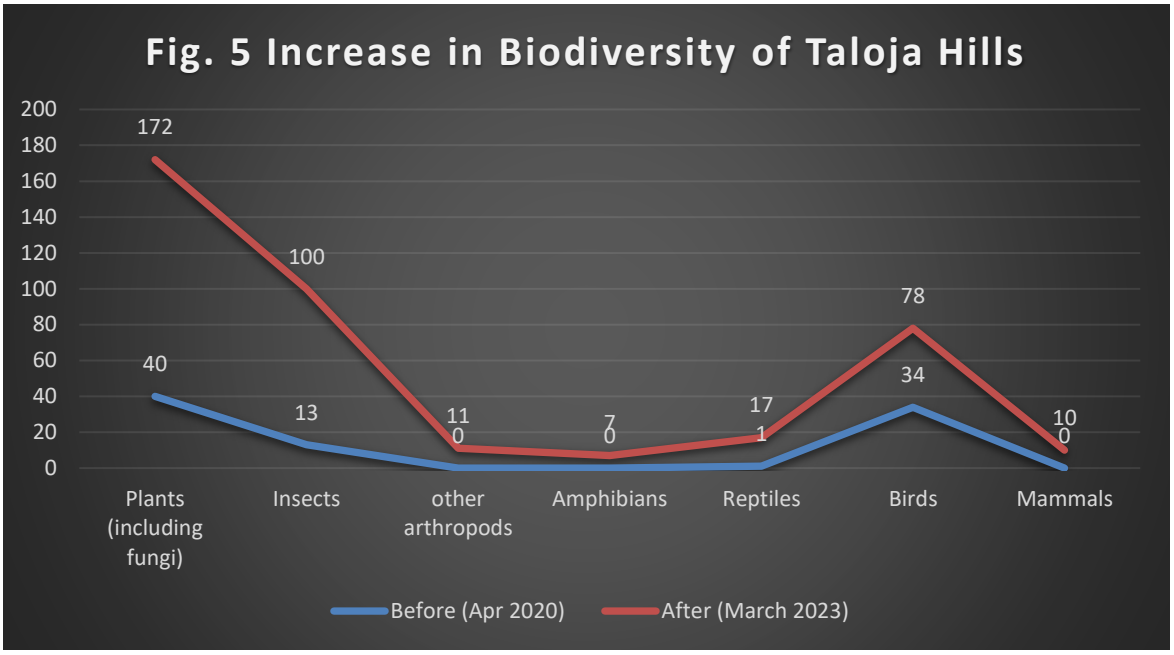
7.3 Project Activities: Following are the details of the project activities.

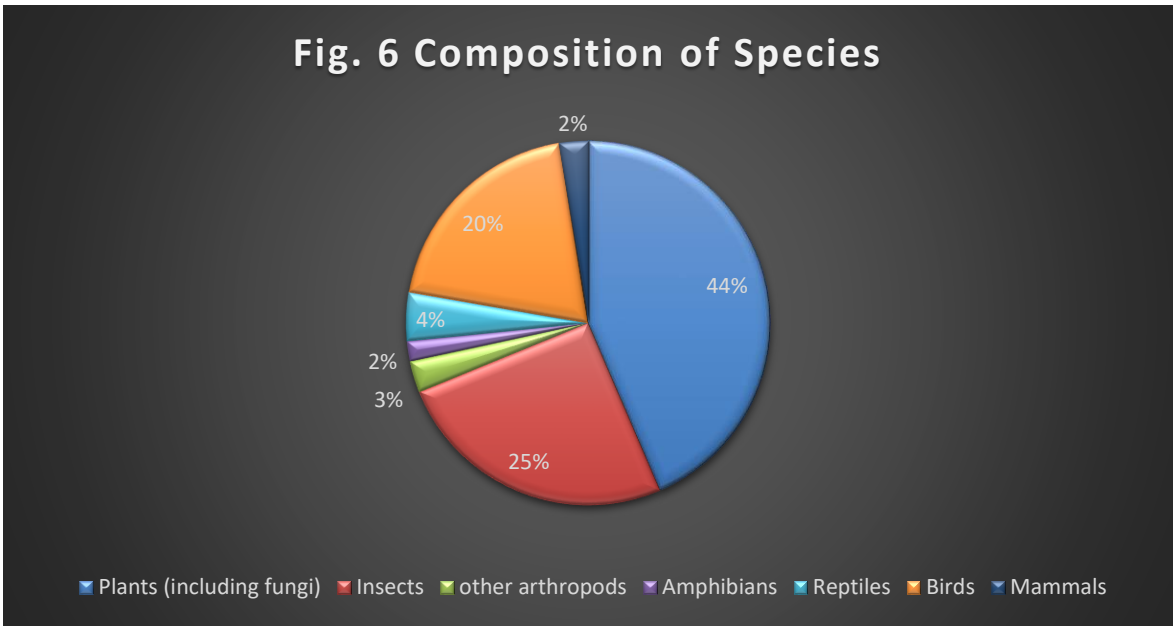
7.3.1 Seasonal Biodiversity Survey: A seasonal biodiversity survey was conducted to assess the biodiversity at the site, for plants, mammals, birds, insects, reptiles and amphibians. During this quarter, the site was surveyed for its winter biodiversity.

The biodiversity surveys, recorded a total of 395 species at the site. The total number of species sighted at site has increased from 309 to 395 (comparison of March 2022 - 2023). The data analysis show how yearwise the species diversity increased. The reason for increase is systematic surveys as well as improvement in habitat. As per Fig. 4, the total plant species has increased from 143 to 172, insect species has increased from 63 to 89 and arthropod species has increased from 0 to 11, amphibians has increased from 6 to 7, reptiles has increased from 16 to 17, birds species has increased from 75 to 78 and mammal species has increased from 6 to 10.



If compared with before and after scenario as per Fig.5, there is an increase in species of 13% in plants, 8% in insects, 22% in birds, and 2% in herpetofauna. The species composition as Fig. 6 shows insect diversity (25%) among the animals followed by birds (20%)





This biodiversity data is being fed regularly on the iNaturalist portal (Taloja Hill Watershed Project · iNaturalist). iNaturalist is a social network of naturalists, citizen scientists, and biologists built on the concept of mapping and sharing observations of biodiversity across the globe. Following are the details of the survey and the species observed in this quarter Table 3.

Table 3: List of Number of Species of Flora and Fauna observed per quarter and total

Sr. No	Class	20-Apr	21-Mar	22-Mar	23-Mar	Apr-Jun 22	Jul-Sep 22	Oct-Dec 22	Jan-Mar 2023
1	Plants (including fungi)	40	118	143	172	61	74	53	42

2	Animals	48	126	166	223	29	59	80	97
	Total	**88**	**244**	**309**	**395**	**90**	**133**	**133**	**139**

- **Plant Survey:** The plant surveys were conducted by Dr Shreya Bhanap and Ms. Gauri Gurav. All the plants observed during the survey were commonly seen at the site. The species of plants observed at the site has increased to 172 species during the year compared to the 143 species of plants observed in March 2022. Following is the Table 4 with species numbers and the detailed list of Plants observed during the survey and the photographic representation are enclosed as *Annexures 1, 2 & 3*.

Figure 7: Kumbhi Flowers

Table 4: List of Plant Species observed at site (Apr 20-Mar 23)

Sr. No	Type	20-Apr	21-Mar	22-Mar	23-Mar	Apr-Jun'22	Jul-Sept'22	Oct-Dec'22	Jan-Mar 2023
1	Herbs	9	76	90	104	26	32	21	15
2	Shrubs	10	12	22	24	9	11	7	3
3	Trees	21	30	31	44	26	31	25	24
Total		**40**	**118**	**143**	**172**	**61**	**74**	**53**	**42**

- **Animal survey**: Quarterly surveys were carried out to document the seasonal faunal diversity at the site. Survey was done for arthropods, amphibians, reptiles, birds and mammals. Following is the table with the number of animals species observed at site.

Table 5: Number of Animal Species observed at site (April 2020- March 2023)

Sr. No	Class	20-Apr	21-Mar	22-Mar	23-Mar	Apr-Jun 22	Jul-Sep 22	Oct-Dec 22	Jan-Mar 2023
1	Insects	13	43	63	100	6	18	35	42
2	other arthropods	0	0	0	11	3	1	6	54
3	Amphibians	0	3	6	7	1	1	0	3
4	Reptiles	1	9	16	17	5	4	4	1
5	Birds	34	71	75	78	11	30	32	5
6	Mammals	0	0	6	10	3	5	3	29
Total		**48**	**126**	**166**	**223**	**29**	**59**	**80**	**97**

- **Insect Survey and other Arthropod Survey**: The insect surveys were conducted by Dr. V Shubhalaxmi, Ms. Priti Choghale and Ms. Roshni Tiwari. The species of insects observed at the

site has increased to 100 species during the year compared to the 63 species of insects observed in March 2022. Apart from this other arthropod like spiders, scorpions and millepedes were also observed at the site. A total 11 species of other arthropods were observed at the site compared to zero species observed in March 2022. The number of insects and arthropods have increased to 111 (March 2023) compared to 63 species observed during March 2022. The highlight of the survey was the sighting of the Blue Pansy butterfly. The detailed list of insects and other arthropods observed during the survey and the photographic representation are enclosed in *Annexures 4, 5 & 6*.

Figure 8: Blue Pansy Butterfly

- **Herpetofauna Survey**: Herpetology is the study of amphibians and reptiles. Mr. Ved more, Roma tripathi and Mr. Nishant Umralkar conducted the herpetology survey. The species of amphibians observed at the site has increased to 7 species compared to the 6 species of amphibians observed in March 2022. Apart from these the species of reptiles has increased to 17 compared to the 16 species observed in March 2022. The number of herpetofauna sighting at the site has increased this year. The survey details and the photographic representation is enclosed as *Annexure 7&8*.

Figure 9: Common Indian Toad

- **Bird Survey**: The bird surveys were conducted by Dr. Ketki Marthak. The species of birds observed at the site has increased to 78 species during the year compared to the 75 species observed in March 2022. The number of bird species observed at site has increased by 2 species in this year. Post monsoon a good bird activity was noted at the site and the migratory birds have also started coming. The highlight of the survey was the sighting of the Siberian Stonechat which is a migrant. Out of the total 78 species sighted at the site 7 species are migratory. The list of birds observed during the survey and the photographic representation are enclosed in *Annexures 9 & 10*.

Figure 10: Siberian Stonechat

- **Mammal Survey**: The mammal survey was done by Ms. Roshni Tiwari. As per the previous records (March 2022) a total of 6 species of mammals were observed at site. The total number of mammal species observed at the site has increased to 10 during this year (March 2023). Sightings of droppings of Black-naped hare were seen at the site. The detail list and the photographic representation is enclosed in *Annexures 11 & 12*.

Figure 11: Black naped Hare

Some important sightings: The project site is home to numerous species of flora and fauna, some of which have declining populations due to habitat loss, poaching, and wildlife trade, among other factors. For example, Bengal Monitor lizard. Other interesting sightings includes Indian Sundew plant, Hairy Okra, Frilly Lepidagathis and Red Helen Butterfly.

- **Indian Sundew (*Drosera indica*):** An uncommon insect eating plants growing on the rocky, wet slopes and wet mud on the hills during monsoon. They capture the insects with the help of the sticky liquid drop at the tips of the tentacles. The tentacles drown the prey in a digesting enzyme-laced liquid. The carnivorous diets helps them to survive in the poor soil.
- **Hairy Okra (*Abelmoschus Manihot*):** The nearest specie of the edible Ladyfinger. While the large yellow flowers are very ornamental, the importance of this plant is that it is one of the world's most nutritious leafy vegetables because of its high protein content. The leaves are tender and sweet and can be served raw or steamed
- **Frilly Lepidagathis (*Lepidagathis trinervis*)**: Found only in India and Pakistan this ground hugging plant grows on rocky surfaces.
- **Red Helen Butterfly (*Papilio Helenus*):** It was recorded for the first time in the Navi Mumbai area.

Figure 12: Indian Sundew

Figure 13: Red Helen Butterfly

7.3.1.2 Socio-economic Survey of Ova Village near Taloja Hill: Most villages near forests rely on firewood, a dependable biofuel, for cooking on a regular basis. Hence a survey was

conducted to learn more about the key elements in the firewood consumption and other non-timber product habits of the people who live near our Taloja hills. The study was carried out with the help of a primary questionnaire distributed to a female and male from each household who visits the forest on a regular basis or twice a week to collect firewood and other nontimber goods. In total, 32 people responded to our survey. Ms. Roshni Tiwari along with the inter Sameera Hindalekar and Community representative Ms Jyoti Nadkarni conducted the survey on 9th and 10th January 2023.

It was observed that around 73% are using forest wood on daily basis. And 12.5% collect wood on daily basis. 76% use *chulha* at home inspite of having gas. Up to 53.1% are aware of the iNaturewatch Foundation's plantation and 73% are eager to work with us on this project. Our goal was to determine the proportion of local communities that are still completely reliant on the forest.

Figure 14: Figure 8: Socio-economic survey of Ova Village

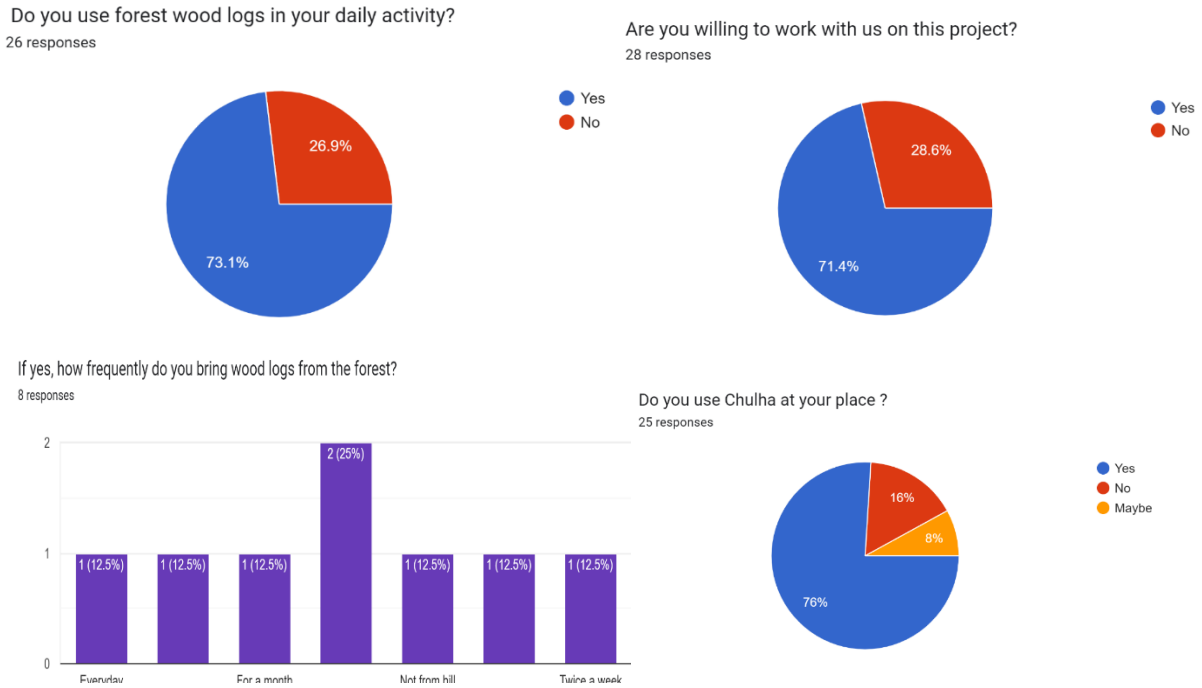


Figure 15: Graphs of survey questioner

7.3.2 Maintenance of the Project Site: The dry season was quite taxing to deal with the increasing heat which increased the possibility of forest fires at the site and the issues of

caretakers. However, regular maintenance of the site was looked after by hiring labourers whenever required.

- **Mulching & Composting**: Caretakers initiated the mulching work along with the ongoing composting work by adding a mixture of Cocopeat and compost to the saplings. Cocopeat will help in retaining the moisture in the soil for a longer period. Also, the dried grass was used to cover the base of the saplings as mulch. Compost was also added to the saplings to enhance the growth rate. Mulching and Composting will improve the water and nutrient holding capacity of the soil, reduces soil erosion and leaching. It aerates the soil and it is also a cost-effective measure. Labourers were hired for this work.

Figure 26 Adding composting and mulch to saplings

- **Tree guard repairs**: Tree guards were also repaired simultaneously while doing the mulching and composting work. Tree guards help to protect the young saplings from grazers and the direct impact to the plants from harsh weather like extreme summer or rain. The tree guards at the site keep getting damaged continuously due to the wind, cattle's and vandalism.

- **Watering of Plantation**: As the rains stopped the soil lost all the moisture and got dried up due to the increasing heat. As a result, the plants started showing signs of water deficiency like the leaves started turning yellow and started wilting. Hence, we started watering the saplings which needed water from 3rd November 2022 onwards. However, from 23rd November all saplings at the site were watered on regular basis.

Figure17: Caretaker watering plants

- **Development of Forest Nursery**: The forest nursery was developed in the first quarter of the project by using green plastic net shed and bamboos. Native seeds from the hill were collected and sown in sapling bags in July and the second quarter. 390 sapling bags were prepared. Currently 117 saplings are surviving and growing well in the nursery. This includes Kanchan, Custard apple, Wild banana, Imli, Indian almond and Red bead tree. The saplings are watered regularly and are take care of by the caretakers. List of saplings surviving in nurser are given below in table 5.

Figure 18: Development of forest nursery

- **Invasive species removal**: To aid in the regeneration of native species, we are removing American Mint which is an invasive species. An invasive species is an organism that is not indigenous, or native, to a particular area. Invasive species can cause great economic and environmental harm to the new area. However not all non-native species are invasive. The invasive American Mint is spreading fast and covering the hills as it propagates quickly. It prevents the growth of native plants on the hill. Hence it is important to remove it.

Figure 19: Invasive Species removal

Table5: List of saplings in Nursery

Sr. No.	Name	Number of Saplings
1	Wild Banana	2
2	Custard Apple	3
3	Desi Badam	3
4	Kanchan	32
5	Red Bead Tree	3
6	Unidentified	20
7	Unidentified	28

8	Fever nut	26
	Total	**117**

- **Soil and Water Testing**: The soil and water sample was collected from the site and sent for testing at the Environmental department of the SIES college Nerul on 16th March 2023. The report is attached as Annexure 13. As per the soil test report the soil at the site has become slightly alkaline (7.60) earlier it was acidic (5.52) in 2020. Organic carbon is high in the soil. However, N, P, K is very less.

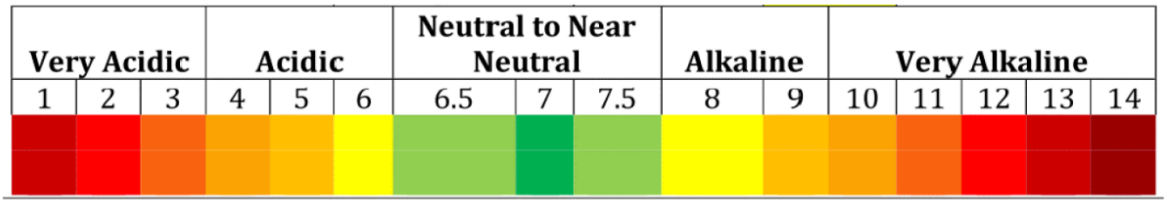


Table 6: Comparison of Soil nutrients (2021- 2023)

Sr. No.	Soil pH and nutrients	2020	Nov 2021	9 April 2023
1	pH	5.52	6.5	7.60
2	Potassium	938 mg/kg	0.70	0.12 mg/l
3	Phosphorous	78 mg/kg	0.80	2.33 kg/ha
4	Nitrogen	1423 mg/kg	0.70	0.0644mg/gm
5	% Carbon	10.8 %	1.00 %	1.74%

Water Test:

Sr. No.	Soil pH and nutrients	2020	March 2022	9 April 2023
1	pH	7.71	7.88	7.64
2	Total Solid mg/l	165 mg/l		0.12 mg/l
3	Total Dissolved Solids	158 mg/l		2.33 kg/ha
4	Turbidity		1.8NTU	18.5NTU
5	Total Hardness		51 mg/l	104 mg/l
6	COD	10.3 mg/l		104 mg/l
7	BOD			1.89mg/l
8	Sulphates	5.0 Mg/l		1.74%
9	Chlorides	49.77 mg/l	184.6 mg/l	51.69 mg/l
10	Ammonical Nitrogen	0.8 Mg/l		

The pH is slightly alkaline, but found to be withing permissible limits. Conductivity, turbidity and BOD parameters are within the permissible limit and the water is found to be potable for usage.

7.3.3 Nature Trail Development: A nature trail was to be developed at the site however, the forest department did not allow us to carry out these tasks as they had bigger plans of making longer nature trails. And had their own budget to execute these works. Hence instead of the development of nature trail the following new activities were carried out for the project which added a value to the project.

- **Pictorial Guide to Wildlife of Taloja Hill Forest**: A 18-page pocket field guide brochure was developed which capture the biodiversity highlights recorded from the project site. The specifications are as follows:
  - Size: Open 38X9 inches, close 9x4 inches, 8-fold, 18 pages
  - Number of species covered: 49 (birds, butterflies, wildflowers, insects, herpetofauna, mammals)
  - Printing: 4 colour offset printing with lamination
  - Quantity: 2000 (1500 English)
  - Paper Quality: 300 GSM
  - Purpose: Acts as an educational souvenir for visitors especially school students for whom we will be conducting nature trails. Also provides branding opportunities.

  The field guide was released by eminent wildlife conservationist Mr Bittu Sahgal, Founder-Sanctuary Nature Foundation on 24th March 2023 and Hornbill House, BNHS. 40 participants attended the release function and it was covered in eight news articles. It was highly appreciated by the print media along which the efforts taken for the reforestation of the Taloja Hills. We have given 70 copies of the field guide to the Forest Department and 30 copies were sent to DCB Bank. The field guides are given to the participants who attend the volunteering and nature awareness programmes at site.

Figure 20: A Pocket Field Guide to Taloja Hill Forest

- **Field -Naturalist training Programme:** As we had over 150 volunteers who joined us during the course of project, it was worthwhile to train handful of interested volunteers into Nature Guides. These guides will lead nature trails for forest department for the visitors who explore the Taloja hill. This will complete their learning cycle and create better community ownership.

Figure 21: Field activity

Hence a four weekend Naturalist Training Programme was conducted in the month of February 2023. The weekend module was a hybrid including morning field sessions and evening online lectures. It covered different themes like, plants, insects, herpetology, birds, environment education, biodiversity survey techniques, communication skills.

25 participants attended and completed the training programme. These participants were short listed after conducting an online interview of the participants who had applied for the programme. A valedictory function was conducted on 3rd March 2023 at the Community Hall in Hyde park. Mr Sanjay Waghmode DFO Forest Department attended the function and felicitated the participants with certificates and field kits. A Nature Trail Manual was also developed and given to the participants.

The details of the training programmes are as follows:
Dates: February Weekends (Sat-Sun) 3, 4,5,11,12,18,19,25,26 February & 3 March 2023
Time: Morning – 8.00 a.m. to 10.00 a.m. & Evening 7.00 p.m. to 8.00 p.m.
Venue: Taloja Hills
Training Components: How to use the pictorial field guide? How to conduct nature trails? How to identify common birds, butterflies, trees? How to communicate scientifically? How to create educational materials? How to conduct different kinds of environmental educational programmes.

7.3.4 Project Video: The video shooting for developing the short video was conducted on 12th February 2023 at the site. A video scrip has been developed for the same covering all the works conducted during the span of three year. The video is under editing process. The video script is attached as *Annexure 14.*

Figure 22: Video Shoot at site

7.3.5 Whats App Group and Facebook Group

- **WhatsApp group**: The active WhatsApp group of volunteers stands at 156 participants. Regular updates are posted on the group along with weekly volunteering activity details. A proactive volunteer base is created through this whatsapp group.

- **Facebook Group**: Project updates are being regularly posted on the project Facebook group so that people and community volunteers are updated with the activities going on at the

restoration site. The name of the group is Hill Reforestation Watershed Project. It consists of 78 community volunteers.

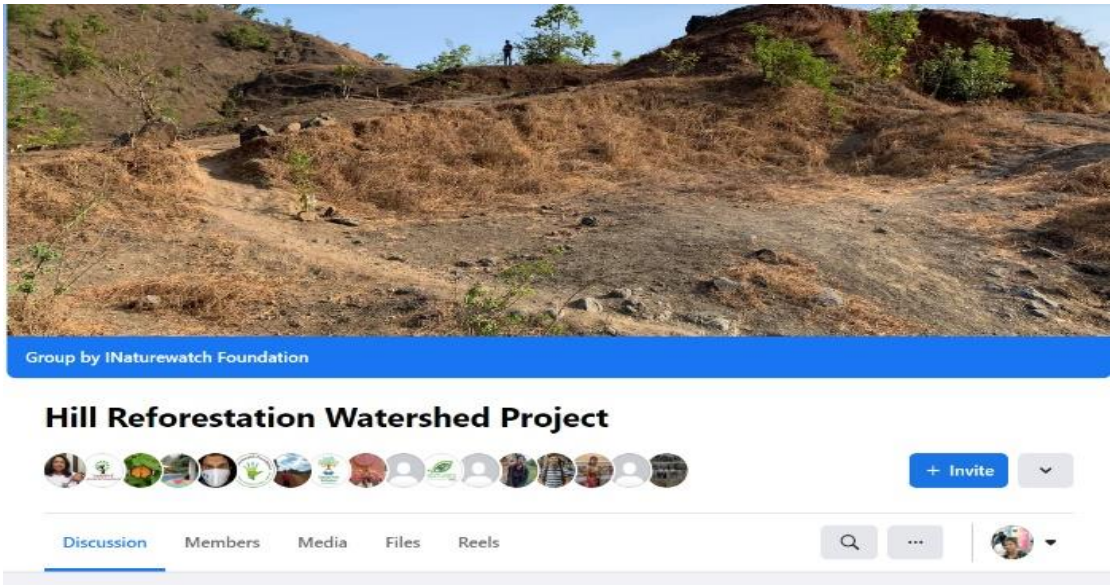


Figure 23: Facebook page

- **Print Media**: Eight leading news papers covered the Field guide release and project details.

i. Mid-Day: 14 January 2023

Greening coming generations

Community-maintained public spaces across the city remind this diarist of the driving force of a people that comes together for good. In the last three years, the watershed area of Taloja Hills in Kharghar saw efforts for reforestation overseen by iNaturewatch Foundation.

After planting over 6,000 trees, the project is nearing its end. The next phase before exiting the Taloja Reforestation Project site includes training guides to conduct nature trails at Taloja Hill Forest. Founder of the organisation, Dr V Shubhalaxmi shared that nature trails will allow people to not just enjoy the area, but help them respect and appreciate it. "During the three years, volunteers from Kharghar helped execute aspects of the project. With the programme, this available community will be able to conduct nature trails since they have been designed for people from a non-science background but with a flair for teaching and an interest in nature," she said.

(Top) Dr V Shubhalaxmi guides a trail at Taloja Hills; trees being planted at the hills

ii. Mumbai Tarun Bharat: 25 March 2023

https://www.mahamtb.com//Encyc/2023/3/25/taloja-field-guide.html

तळोजा हिल फॉरेस्टची सर्व माहिती छोट्याशा फिल्ड गाईडमध्ये

25-Mar-2023 समृद्धी ढमाले

iii. Hindustan Times: 25 March 2023

https://www.hindustantimes.com/cities/mumbai-news/three-year-reforestation-transforms-biodiversity-at-taloja-hill-forest-101679767525732.html?mibextid=Zxz2cZ

iv. Salak: 27 March 2023

सकाळ

फिल्ड गाईडचे अनावरण

खारघर (बातमीदार) : आयनेचर फाऊंडेशनच्या वतीने तळोजा हिल फॉरेस्ट फिल्ड गाईडचे अनावरण शुक्रवारी (ता. २४) बीएनएचएसमध्ये करण्यात आले. या वेळी प्रमुख पाहुणे म्हणून सेंच्युरी नेचर फाऊंडेशनचे बिट्टू सहगल उपस्थित होते. या फिल्ड गाईडमध्ये १९३ वनस्पतींच्या प्रजाती, ८४ कीटकांच्या, सहा उभयचर, १६ रेपटाईल्स, ७७ पक्षी आणि १० सस्तन प्राण्यांच्या प्रजातींची नोंद तळोजा हिल फॉरेस्टच्या भागात करण्यात आली आहे. आय नेचर फाऊंडेशनच्या डॉ. व्ही. शुभलक्ष्मी, बटरफ्लाय मॅन ऑफ इंडिया आयझॅक किहीमकर, प्रीती चोगले आणि आयनेचर फाऊंडेशनच्या इतर सदस्यांच्या एकत्रित प्रयत्नांतून हे फिल्ड गाईड तयार करण्यात आले आहे. आयनेचर फाऊंडेशनच्या वतीने तीन वर्षांपूर्वी तळोज्यामध्ये वृक्ष संवर्धनासाठी प्रकल्प सुरू केला होता. या वेळी काम करताना आढळणाऱ्या सर्व वनस्पती, प्राणी, फुले, पक्षी, कीटक यांचा समावेश गाईडमध्ये करण्यात आल्याचे फाऊंडेशनच्या डॉ. शुभलक्ष्मी यांनी सांगितले.

v. Mid-Day: 28 March, 2023

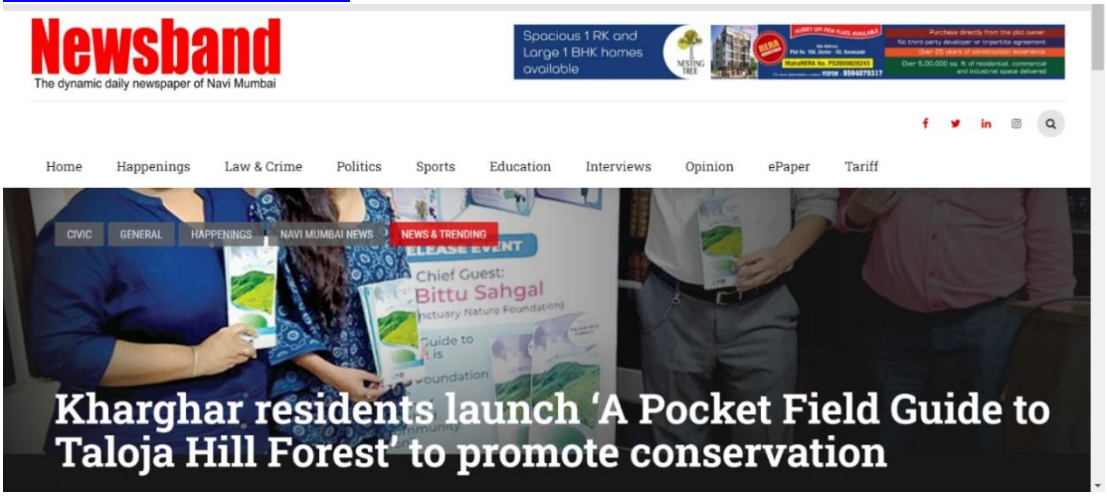
https://www.mid-day.com/mumbai/mumbai-news/article/mumbai-diary-tuesday-dossier-23277675

The natural route to Taloja

While Navi Mumbai boasts of a greener patch than the rest of the city, its flora and fauna remain highly unexplored. In a more detailed effort to highlight this, iNaturewatch Foundation released a field guide last week at BNHS Hornbill House, after the conclusion of Taloja Hill Forest Restoration Project. Dr V Shubhalaxmi, founder and co-author of the guide, told us, "Last month,

vi. Newsband-The dynamic daily newspaper of Navi Mumbai: 23 March 2023

https://newsband.in/?p=39500



Newsband

The dynamic daily newspaper of Navi Mumbai

Spacious 1 RK and Large 1 BHK homes available

Home Happenings Law & Crime Politics Sports Education Interviews Opinion ePaper Tariff

CIVIC GENERAL HAPPENINGS NAVI MUMBAI NEWS NEWS & TRENDING

Chief Guest: Bittu Sahgal

Kharghar residents launch 'A Pocket Field Guide to Taloja Hill Forest' to promote conservation

vii. Mid-Day: 2 April 2023

06 | sunday mid-day 02.04.2023 | CITY

'I'm waiting for the fireflies to return'

Taloja Hill's reforestation success story started with the depressing view from a new resident's window

SHARANYA KUMAR

ALONG the stretch of hills in the Kharghar region of Navi Mumbai, one hill is special. It's called Taloja Hill due to its proximity to Taloja Central Jail, and is the site of a three-year reforestation initiative led by local residents, non-profit iNaturewatch Foundation and the Forest Department.

The success story's origins go back to 2016, when environmentalist and animal welfare officer Jyoti Nadkarni first moved into a residential building that faced the hill. "At the time, the land was barren. The few trees that existed were chopped by villagers for firewood once they reached a certain height. Illegal mining was also a concern. I soon realised that the only way to make a difference was to take responsibility," she recalls.

Along with a few neighbours, Nadkarni approached the Forest Department for permission to preserve the patch of land. It took three months before the department gave them a nod and offered 100 saplings to get them started. Nadkarni and the volunteers took on reforesting the hill in earnest. A few months later, however, they met a hurdle when a rogue fire engulfed the hill. Nadkarni remembers the residents carrying up 30 litres of water to water the withered plants every day until the monsoon arrived. Slowly but surely, the hill came back into its own.

News of this citizen effort reached Dr V Subhalaxmi, entomologist and CEO of Navi Mumbai-based iNaturewatch Foundation, with whom Nadkarni had once done a long-distance biodiversity course. "When I got the opportunity to draft a CSR proposal, I knew I wanted to help the hill and the community engaged in preserving it," she says. With the support of DCB Bank and the Forest Department's Alibaug unit, iNaturewatch launched an official reforestation project at Taloja Hill in 2019.

In an effort to reintroduce indigenous species to the region, the NGO enlisted a team of botanists, zoologists, ornithologists and entomologists to survey the area, and also consulted researchers from the Bombay Natural History Society. Soil sampling and water tests were conducted, and the topography of the region was studied to determine where the new vegetation would thrive. Reforestation was a challenge due to the rocky terrain and arid weather. The pandemic and subsequent lockdowns made it difficult to hire workers. iNaturewatch decided to once again turn to local volunteers to plant 8,000 saplings over three years.

This is the reason why Taloja Hill now has a lush cover of trees and grass, and is dotted with newly planted saplings protected by green enclosures. A small community nursery near the foot of the hill encourages locals to collect the seeds of native saplings and sow them during the monsoons. A series of coconut shells laid out along the ground demarcates a natural walking trail. One-foot-deep trenches have been dug into the slopes to prevent soil erosion, improve water percolation and trap important seeds.

Over the past few years, the plant species has risen from 38 to 172, insects from 39 to 89, birds from 39 to 89 and amphibians from 9 to 22. In an effort to educate people about the region's biodiversity, iNaturewatch has released a Pocket Field Guide which contains information about 49 species (20 flora and 29 fauna) that can be found on the hill (inaturewatch.org/downloads).

The three-year project concluded in March 2021 with iNaturewatch conducting a four-week training programme to prepare 25 local volunteers, including Nadkarni, to become qualified naturalists. Starting this Sunday, there will be weekly volunteering events and nature trails will be held during the monsoon months.

NatConnect Foundation director BN Kumar says this is an example worth emulating. "It should be seen as a pilot project by other NGOs and companies with CSR funds. Areas like Perali Hill, which has been denigrated by quarrying, can be rejuvenated with similar efforts." Nadkarni emphasises the importance of preserving what little nature there is around us. "My dream is to see fireflies come back here!"

TRACK updates about volunteer programmes @naturewatch

Jyoti Nadkarni's poem with a young banyan tree

A small community nursery near the foot of the hill encourages locals to collect the seeds of native saplings and sow them during the monsoons. A series of coconut shells laid out along the ground demarcates a natural walking trail. One-foot-deep trenches have been dug into the slopes to prevent soil erosion, improve water percolation and trap important seeds.

Green ace insurers holding newly planted saplings (far) Taloja Hill (Right) Jyoti Nadkarni and BN Kumar stand by the tank which holds water pumped from the reservoir at the base of Taloja Hill. PICS/SAMEER MARWADE

viii. Times of India' Mumbai: 03 April 2023

3-yr effort pays off, Taloja Hill richer in flora & fauna

B B Nayak

Navi Mumbai: A 3-year-long voluntary reforestation project at Taloja Hill has yielded significant results with improved conditions for wildlife, vegetation, soil, water and eco-conservation. The project on 7.3 hectares near Kharghar's sector 35-G, launched by iNaturewatch Foundation with the help of local community during the pandemic, has led to a rise in species of plants from the then existing 38 to 172, insects from 39 to 89, birds from 39 to 89 and amphibians from nine to 22, revealed Dr V Subhalaxmi, founder of the NGO.

Based on the project, iNaturewatch has brought out a Pocket Field Guide to Taloja Hill Forest which was formally unveiled by BNHS president Bittu Sahgal recently.

Sahgal, who is also the founder of Sanctuary Nature Foundation, stated that there is a misconception among certain planners that forests come in the way of development which is why one witnesses all-round destruction. Tree cover helps as carbon sinks and contributes to saving the environment. Unfortunately, this basic fact is ignored by those in a hurry to implement infrastructure projects, Sahgal said, adding: "This is why Sanctuary Nature Foundation is working with school children to spread awareness about the environment."

Dr Subhalaxmi said it was an uphill task to get workers to plant 8,000 saplings during the pandemic and lockdown.

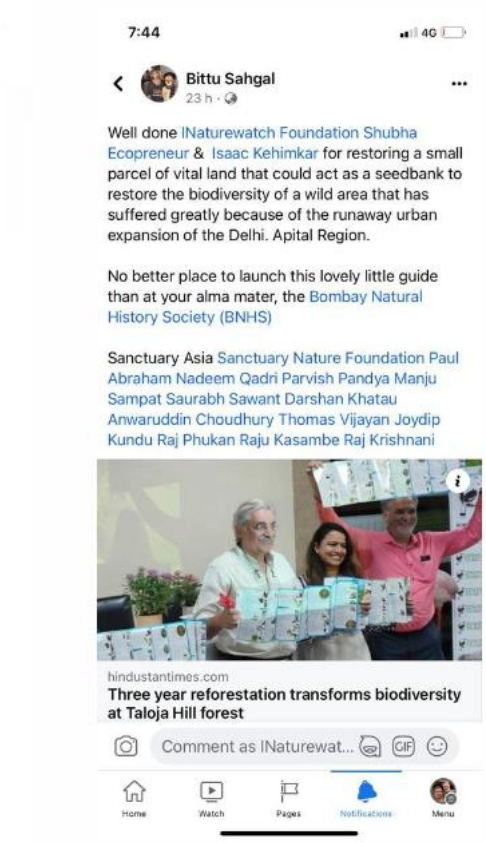
Jyoti Nadkarni

There is now a rise in species of plants, insects, birds & amphibians

Article is on page 4 'Times of India' Mumbai. (03.04.2023)

ix. Facebook review post by Mr Bittu Sahgal, Founder Sanctuary Asia Foundation &

Wildlife Conservationist



8. PROJECT REVIEW

8.1 Plantation Review: The plantation review of the quarter was conducted from 8th March to 13th March 2023 by Ms. Roshni Tiwari. It was observed that 2873 plants survived out of the 5453 saplings at the site. Therefore, a survival rate of 52.8% was noted whereas the mortality was 47.2%. The plantation review list is enclosed as *Annexure 15* and the comparative images are available as Annexure 16.

The high mortality has been due to the major forest fires, harsh weather conditions, constant cattle grazing, and also infestation of insect pests. During the review it was observed that almost all of the Jamun saplings were attacked by leaf miners. Some saplings which had grown very well and attained a good height of upto 12 ft were grazed upon by the cattle's. Insect attack was also observed on some saplings like Red silk cotton trees. Some are also infected by termites.

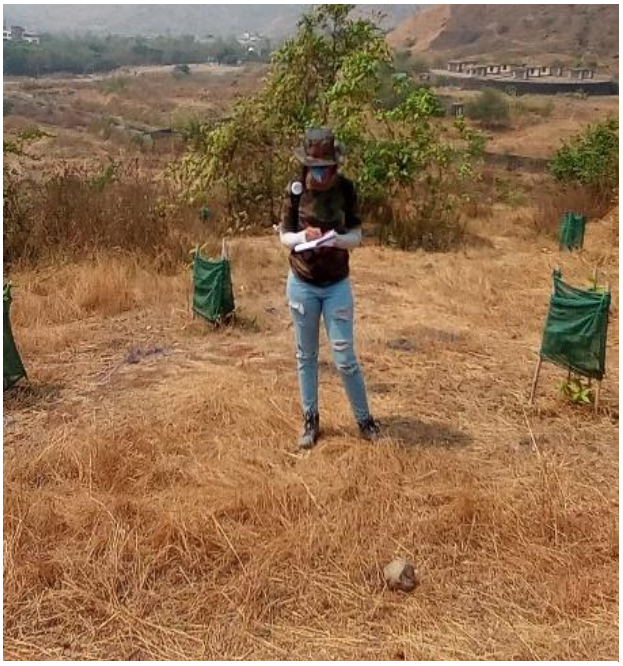


Figure 24: Ms. Roshni Tiwari conducting plantation review

However, the presence of termite is good sign as it indicates increase in soil moisture. They are referred to as "ecosystem engineers" as they can maintain, transform, and support soil fertility. Termites also perform a significant contribution in upholding soil's chemical and physical parameters by excavating and breaking down organic materials when constructing their mounds.

Figure 25: Sapling eaten by cattle, Termite attack, Leaf miner attack

The surviving trees are growing well. Species like Indian Rosewood is growing very well and have attended a height of 15ft and have also started flowering and fruiting. Also the euphorbia cutting which were planted have started flowering. The species like Fever nut, Nirgudi, ixora, barleria have

also started flowering. Fever nuts seeds were collected and sowed in sapling bags to make saplings. The saplings planted in 2020 are growing well and have attended a good height. The saplings planted in 2021 and 2023 have also grown in height**.**

Figure 23: Euphorbia cutting planted flowering & Indian Rosewood seed pods

Figure 27: Sapling planted in 2020 & 2021

8.2 Carbon Sequestration

Carbon sequestration is the process of capturing and storing atmospheric carbon dioxide. It is one method of reducing the amount of carbon dioxide in the atmosphere with the goal of reducing global climate change. Biological carbon sequestration is the natural ability of life and ecosystems to store carbon. Carbon can be stored in plant tissue. Forests, peat marshes, and coastal wetlands are particularly good at storing carbon.

About 25 percent of global carbon emissions is captured by plant-rich landscapes. The key figure of carbon content in a tree is the size of the tree. Bigger trees are usually older and have captured more carbon dioxide from the atmosphere during their life and therefore contain more carbon.

And the GIRTH (circumference) of a tree is a good basic measure of SIZE or how gig the tree is. Girth is measured at chest height 1.3m above the ground. When plants reach to the girth size at 10cm they start storing the carbon inside them. Hence carbon sequestration was calculated for saplings growing at the site to check the carbon storage in our tree saplings. The girth size of the tree saplings were measured and the stored carbon was calculated using the online calculator https://www.northsydney.nsw.gov.au/carbon/carbon.html

The carbon storage in plants remains same as last quarter. Out of the total tree saplings measured 26 saplings have grown 10 cm or more in girth. And have started storing carbon from the atmosphere. The plant which are found to be more than 10 inches are Indian coral tree, Dalbergia, Karanj, and Bauhinia. In which maximum number of carbon storing plant is of Dalbergia sp. Total 129 kgs of carbon was stored in 26 tree saplings. The detail list of tree saplings is enclosed as Annexure 17.

8.3 Qualitative Impacts

- **Plantation**: The land once barren is slowly turning greener as the plantation has progressed since the beginning of the project.
- **Nursery development**: Sapling bags of locally collected seeds were made for future plantation at site.
- **Increase in Biodiversity**: An increase in the total number of species sighted at the site was observed this year.
- **Site maintenance**: Regular site maintenance works like de-weeding, mulching, tree-guard repair and watering have made the site presentable and has attracted public attention.
- **Plant growth**: Species like Barleria, Woodfordia fruticose, Fever nut, Nirgudi, Wild Banana have started flowering and fruiting.
- **Community Engagement**: Community and corporate volunteers were engaged at the site. Apart from this, community members are also visiting the site for Nature Awareness Programmes.
- **Carbon sequestration:** The tree saplings have started storing carbon.

8.4 Quantitative Impacts

- **Plantation**: 2873 plants are surviving out of the 5435 saplings surviving in March 2022 and the compensatory plantation with a survival rate 52.8%.
- **Increase in Biodiversity:** The total number of species sighted at site has increased from 309 to 395 (comparison of March 2022 - 2023). The total plant species has increased from 143 to 172, insect species has increased from 63 to 100 and arthropod species has increased from 0 to 11, amphibian species has increased from 6 to 7 species, reptile species has increased from 16 to 17 species, bird species has increased from 75 to 78 and mammal species has increased from 6 to 10.
- **Nursery development:** 117 saplings grown from seeds are growing well in the nursery.
- **Community Engagement**: A total 602 participants were engaged in the different volunteering activities and nature awareness programmes conducted at the site. However we had fall short of 258 participants we intend to complete this target during the monsoon by conducting nature trails at the site.
- 129 kgs of carbon was stored in 26 tree saplings.

8.5 Challenges

Apart from extreme weather conditions like heavy rainfall and extreme heat, we faced other challenges at the site as follows

- **Caretakers**: Appointing caretakers at the site has been a challenge for us from the beginning of the project as it is a very difficult terrain to work on. Every quarter either the caretakers left job or we had to fire them due to their nonperformance. In the fourth quarter we had appointed Mr. Prakash Katkari and Anil Khatkari from 11th January 2023 onwards. Hence, we had to employ labourers as and when required on the site.

- **Cattle grazing**: Cattle grazing continues to be problem at the site. Local cattle herders bring their cows, buffalos and goats at the site for grazing. Cattle were seen grazing at the site very often. These cattle fed on leaves and twigs of the plants, and also break the branches of some plants while feeding.

Figure 28: Cattle grazing at site

- **Vandalism**: Since it is a secluded and easily accessible area, vandalism has been a prolonged challenge faced by us on the site. Visitors break the branches of the saplings and the tree guard bamboo and nets are pulled out and throw at site. In the earlier quarters the acknowledge board and water tanks were also vandalized.

Figure 29: Tree guard vandalized

- **Forest Fire**: During the period from January to March 2023 five forest fires had taken place at the site. Of these two were quite large which burned and damaged the saplings and tree guards and increased the plant mortality. However, the caretakers noticed the, and the fire was extinguished. Community member Ms. Jyoti Nadkarni and Mr Nitin was quite helpful in calling the fire brigade and being vigilant.

Sr. No	Forest Fire on Taloja Hill

1	9th January 2023
2	18th January 2023
3	26th January 2023
4	26th February 2023
5	1st March 2023

Figure 30: Forest fires at site

9. STAKEHOLDERS' ENGAGEMENT (Target for the year: 860, Achieved: 602)

The stakeholder's engagement target for the year of 860. We were able to engage 602 passionate community and corporate employee volunteers in activities like De-weeding, Tree guard repair, Watering, Seed collection, Check dam building, Plantation and clean-up at the site. We also conducted nature awareness programme for school and college students.

During the fourth quarter we conducted a carbon sequestration activity with 14 students of Ramniranjan Jhunjhunwala college on 30 December 2022. A corporate volunteering event was organized for the employees of DCB Bank on 13th January 2023 wherein employees helped with clean-up, seed collection, and tree guard repairing. We also conducted the Naturalist training programme and release function of the Pocket Filed Guide to Taloja Hills.

Also, the volunteering programme for 66 extra participants conducted at the Sanjay Gandhi National Park site is adjusted in Taloja site. The details of the events are given below in the Table 6 and the photographs are attached as *Annexure 18*.

Table 6: Event Details with number of participants

Sr.No.	Date	Event Name	Group	No. of Participants
1	22nd April 2022	Seed Collection Drive	Community (5)+DCB Bank employees(3)	8
2	15th May 2022	Seed Collection and Sapling Bag Making	Community	3
3	22nd May 2022	Seed collection and Mulching event	Community (9)+DCB Bank employees(6)	15
4	5th June 2022	Checkdam building event	DCB Bank employees	4
5	12th June 2022	Watering event	Community	5
6	19th June 2022	Compost adding event	Community	3
7	26th June 2022	Compost adding event	Community	5
			Total	**43**
1	3rd July 2022	Plantation and Sapling bag making	Community	22
2	23rd July 2022	Plantation	Community	12
3	7th August 2022	Nature Walk	Community	5
4	9th August 2022	Plantation	DCB Bank employees	48
5	12th August 2022	Plantation	Community	28
6	25th September 2022	De-weeding and clean up	DCB Bank employees	14
			Total	**129**
1	25th November 2022	Nature Walk	Community	1
2	10th -11th December 2022	Kharghar hills Mountain Festival 2022	Community	155
3	17th December 2022	Nature Walk	Community	35
4	30th December 2022	Tree Girth Measurement	College students	14
			Total	**205**
1	13th January 2023	Clean-up drive, Wild seed collection, Tree guard repair	DCB Bank employees	64
2	4th Feb- 26th Feb 2023	Naturalist Training Programme	Training Programme	25
3	3rd March 2023	Validatory Function	Community	30
4	24th March 2023	Release of Taloja Field Guide	Community	40
			Total	**159**
Following are the details of the extra number of volunteers which were catered at Sanjay Gandhi National Park site.				
1	9th October 2022	De-weeding	Community	1

2	16th October 2022	Volunteering by students of SVKM Mithibai College	Community	10
3	12th November 2022	Bird Watching on Salim Ali Birth Anniversary.	Community	25
4	3rd December 2022	Nature trail for School students of Taraben Master English Secondary School	Community	30
			Total	**66**
			Grand Total	**602**

- **Carbon sequestration Volunteering event (30th December 2022):** A volunteering event was conducted for 14 students of Ramniranjan Jhunjhunwala college of Botany and ESDM department at Taloja Hills. They help in measuring the tree girth for calculating carbon sequestration of trees at site. During the programme, student learned about the forest restoration techniques used at the site and the local biodiversity of the place.

Figure 31: Volunteers learning how to measure tree girth

- **Clean-up drive, Seed Collection, & Tree Guard Repairing Volunteering Activity (13th January 2023**): We held an Employee Volunteering Program for DCB Bank employee at Taloja Hills, Kharghar. Sixty-five employees participated in the programme and assisted with site clean-up, tree guard repair, and seed collection. Group 1 of 30 volunteers collected non-biodegradable materials from the site, such as plastic bottles and bags. They removed 20 gunny sacks of plastic garbage from the location. The second group of 25 participants repaired 40 tree guards. 10 participants in group 3 collected seed from wild plants such as silver spike cockscomb, coat button, wild lady finger, wild sesame, wild cotton, and fever nut.

Figure 32: Group Photograph DCB Bank employee

Figure 33: Volunteers doing clean-up drive, seed collection and repairing tree guard

- **Naturalist Training Programme (3rdFebruary - 3rd March 2023)**: A Naturalist Training Programme was organized to train the volunteers and enhance their skills to conduct nature trails at the Taloja hills. A four weekend hybrid module including field and online lectures was developed for the same. 25 nature enthusiast and naturalist from Mumbai and Navi Mumbai area were selected and trained during the programme. The participants were provided with study materials and field kits which will be helpful for them while conducting the nature trails. The nature trails and field activities were conducted during the morning time from 7.00 a.m. to 10.00 a.m. at the site whereas expert lectures were conducted online in the evening. Participants enjoyed themselves and gained a lot of knowledge.

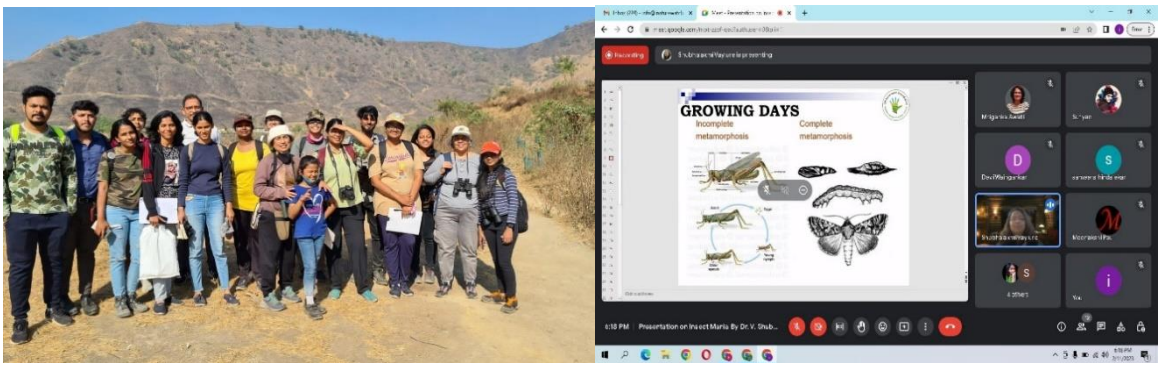


Figure 34: Naturalist Training Programme

- **Valedictory Function of Naturalist Training Programme at Kharghar (3rd March 2023):** The World Wildlife Day was celebrated by felicitating the participants of the naturalist training Programme. The

event was organized at the Hyde Park community hall. 30 enthusiastic Naturalist Training Programme participants their family members and the officials of Alibaug Forest Department attended the programme. Shri Sanjay Waghmode, DFO, felicitated the participants by giving them the certificates and field kits as a sign of appreciation. He also addressed the participants on the topic of forest conservation.

Figure 35: Valedictory Function of Naturalist Training Programme

- **Release of Pocket Field Guide to Taloja Hill Forest:** The release event of Pocket Field Guide to Taloja Hill Forest was done in Hornbill House by the hand of Mr. Bittu Sahagal (The founder of Sanctuary Nature Foundation) on 24th March 2023. Ms. Wilma D'chuna (CSR Manger, DCB bank) also joined and represented DCB Bank during the event. Dr V Shubhalaxmi conducted a presentation for the participants on Taloja hills and its restoration techniques used during the project. Later the field guide was released by Mr Bittu Sahagal and he addressed the participants. The function end with field guide distribution and light breakfast.

Figure 36: Release Event of Pocket Field Guide to Taloja Hill Forest at BNHS by Mr. Bittu Sahgal

10. PROJECT OUTCOMES

Goal Set	Achieved
Environmental	
Creates biological corridors with food & homes for animals and birds specially pollinators	Some species have started flowering and fruiting like Barleria, Fever nut, Indian Rosewood, Kala Umber and so on providing food and shelter for animals and birds specially pollinators.
Protects water resources and rivers	
Controls erosion	The contour bunds and check dams where developed to control erosion. Also grasses like bamboo and vetiver along with other shrubs were planted to cover barren soil.
Enriches soil with nitrogen and other minerals	Nitrogen fixing leguminous plants like Flame of Forest, Pongam, Acacia, Indian Coral Tree Indian Laburnum, Indian Rosewood
Purifies air	
Increases water recycling and humidity control	
Produces oxygen	2873 Sapling planted produces oxygen.
Carbon sequestration	129 kgs of carbon was stored in 26 tree saplings
Climate mitigation for the region	
Economy	
Long term tree nursery, planting and maintenance jobs	Locals from nearby villages are hired as caretakers
Production of fruit, nuts and value added forest products for local farmer's markets	
Development of community owned ecotourism projects	
Society	
Fair pay per day of work equals to empowerment to local communities	
Stops deforestation through alternative income development	
Sustainability & Reforestation Education	
Organic farming practices free of chemicals	
Local participation	
Resilient region and planet	

Table 7: Project outcomes and the Biodiversity Targets they achieve

Sr. No	Project activity	Outcome	Aichi Biodiversity targets	National Biodiversity Targets	UN Sustainability Development Goal Targets
1	Afforestation	Greening of barren land, creating canopy plugs for biodiversity	Aichi Targets 5, 14	National Biodiversity Target 2	SDG 15
2	Habitat restoration	Restoration of a degraded area to provide food and shelter to local wildlife	Aichi Targets 5, 13 15	National Biodiversity Target 3	SDG 15
3	Climate action	Carbon sequestration, reducing soil erosion and recharging ground water level.	Aichi Target 15	National Biodiversity Target 3	SDG 13
4	Biodiversity population	Rise in the total number of species observed at the site through subsequent surveys	Aichi Target 13	National Biodiversity Target 6	SDG 15
5	Community engagement	Engaging corporate and community members in plantation related activities helps in destressing the participants and getting a fresh dose of oxygen with the outdoor session	Aichi Target 1	National Biodiversity Target 1	SDG 3
6	Local employment	The project provides employment to capable locals of the community	Aichi Target 18	National Biodiversity Target 11	
7	Partnership for goals	Joint effort by DCB Bank, iNaturewatch foundation, Forest Department and local community	Aichi Target 2	National Biodiversity Target 2	SDG 17

11. WORKS PLANNED AND COMPLETED

The work activities initiated and commenced till now over the expected time-scale

Table 8: Status of work planned and completed from April 2022 to March 2023

Project Activities	April 2022 to March 2023				Work Status % of Completion	Comments
	Q1	Q2	Q3	Q4		
Conducting seasonal biodiversity surveys	✓	✓	✓	✓	100%	Summer, monsoon, and post monsoon biodiversity surveys are completed
Maintenance of Plantation	✓	✓	✓	✓	100%	Plantation was carried out and their tree guards are installed and maintained
Maintenance of Irrigation	✓	✓	✓	✓	100%	The water pump, pipes and tools are being kept properly
Nature Trail Development, Signages, Activity Stations	X	✓	✓	✓	100%	Nature trail development was dropped. Instead of it we developed A pocket field guide to Taloja hills and conducted Naturalist Training Programme. A pocket field guide to Taloja hills was developed printed and released on 24th March 2023. And 25 nature enthusiast were trained in the Naturalist Training Programme.
Maintenance of Project site	✓	✓	✓	✓	100%	Site maintenance was carried out by conducting deweeding, and composting .
Mulching	✓		✓		100%	Mulching was done during the dry seasons.
Fire protection	✓		✓		100%	Dry grass was removed from the site and fire line were made to avoid the forest fire
Development of Forest Nursery	✓	✓	✓		100%	A forest nursery of green net and bamboo was developed at the site in first quarter. Seeds collected from forest were sowed in sapling bags in the second quarter. 91 saplings grown from seeds are been nurtured during the third quarter.
Making of Project video	✓	✓	✓	✓	95%	Final video shoot was done on 12February 2023. The video is getting edited.
Community Participation Programmes	✓	✓	✓	✓	70%	A total 602 participants were engaged in the different volunteering activities and nature awareness programmes conducted at the site. However we had fall short of 258 participants we intend to complete

						this target during the monsoon by conducting nature trails at the site.
Project Review Reporting	✓	✓	✓	✓	100%	First, second, third and fourth quarter report is submitted.

12. FUTURE PLANS FOR APRIL-MAY 2023

Even though the project ended in March 2023 we are not exiting the site until the monsoon as the saplings will need regular watering until the rains start. Our caretakers will take care of the plantation till the monsoon. We will also be working on interventions like removing invasive species, building check dams, pathway repairs, and earth plugs. We have already started working on the same. The caretakers have already started removing the invasive species. They have removed American mint an invasive species which is growing at the site and spreading fast. We have also developed eight Check Dams at strategic points with the help of caretakers and local community volunteers.

Figure37: Removal of invasive species

Figure 38: Check dams created by Volunteers

The caretakers are also repairing nature trail pathways by filling stones and soil in depressions, gape filling in deep crevices, leveling wherever required, making steps for easy of climb wherever required and stone pitching for demarcation of pathway edging. We are also going use earth plug concept wherein we will be filling gunny sac with soil and placing them in area where earth banks is cutting and getting eroded. We will be making hole in them and then later planting saplings or seeds in them. This will help in restricting erosion.

Also, we are gearing up to mobilise local community support in a big way by organising the "Rebuilding Taloja Hills Volunteering Events" every weekend.

We have planned a series of events for the next three months (April, May, June 2023). Also we will be conducing nature awareness programmes like nature walks along with volunteering

programmes for 285 participants to complete the Community Participation Programmes target of 860. We have already conducted three volunteering programmes in April 2023 and have also distributed the field guides to the participants.

Rebuilding Taloja Hills Volunteering Programmes

Sr. No.	Date	Activity	No. of participants
1	2 April 2023	Pathway Restoration	11
2	9 April 2023	Check dam building	5
3	16 April 2023	Nature Trail	8

Our ultimate aim is to replicate the forest patch in the adjoining area at the project site. For the same we are also conducting biodiversity survey of the adjoining forest area on 3rd May 2023.

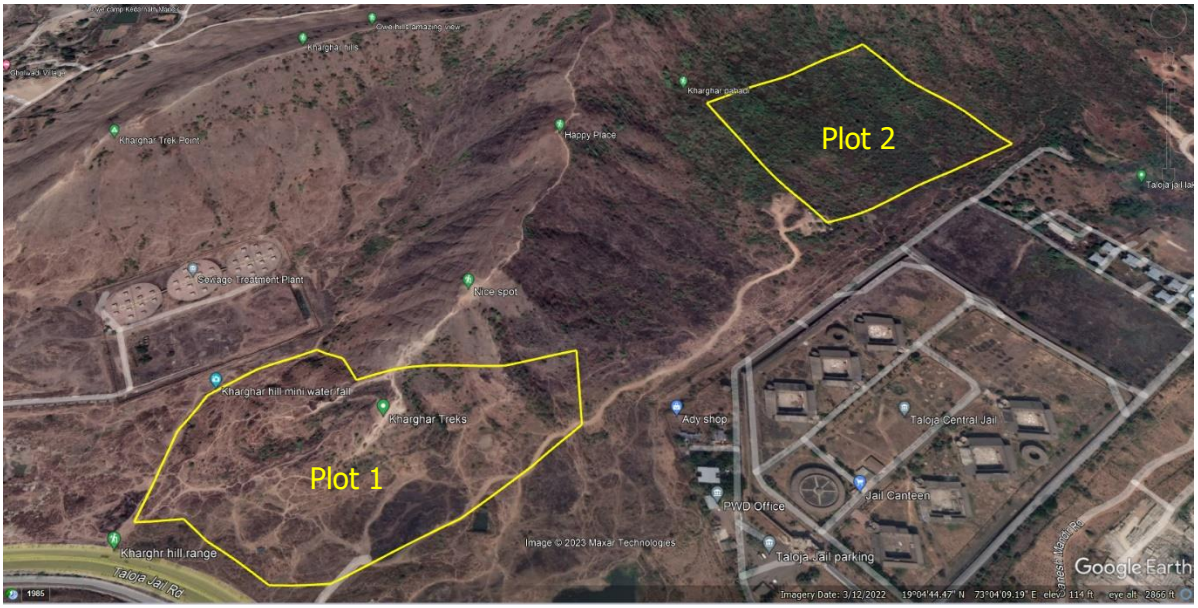


Figure 39: Project site (Plot 1) & Natural Forest (Plot 2)

For the same Dr V Shubhalaxmi had a meeting with Mr. Ashish Thakre, Deputy Conservator of Forests at the Aligaug Forest Office to discuss the current project outcome and future plans. The Forest Department has appreciated the work done and as per them achieving this survival rate of plantation is quite commendable compared to the poor soil quality, degraded area and other issues faced at the site. They have agreed to give us five year extension if we can get the funding. They also agreed to put up gate and boundary to Taloja. They will set up trails too and engage our trained naturalist. We have given 70 field guides to the Forest Department.

Sr. No.	Activity	Description
1	Maintenance of Plantation	Maintenance of the plants will be looked after.
2	Maintenance of Project site	Watering the existing trees regularly. Remove invasive species growing at the site
3	Creating Saplings for Forest Nursery	Develop saplings from seeds, cuttings, and saplings growing in wild in sapling bags.
4	Nature Awareness Programmes	Conduct nature trails for students and general citizens
5	Promotion of Project	Post regular Project updates online.

6	Rebuilding Taloja Hills Volunteering events.	Check dams, pathway repairs, seed collection, nursery work

13 IMPACT STATEMENT

- **Volunteer Base**: A volunteer base of 165 members from diverse walks of life have now become a strong supporter for Taloja Hills. Our project providing rare volunteering opportunities which is otherwise unheard in Mumbai. While this has been not the purpose of our project but we are helping in enhancing the scientific acumen in common citizens, thus creating new citizen scientists. We therefore get continued selfless support from these volunteers. They have enhanced our sphere of influence.

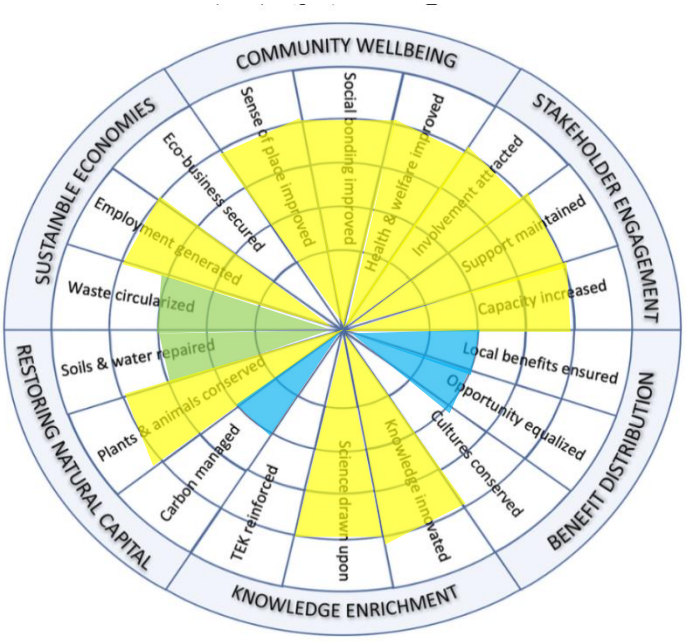
- **Biodiversity:** The total number of species sighted at site has increased from 309 to 395 (comparison of March 2022 - 2023). The total plant species has increased from 143 to 172, insect species has increased from 63 to 100 and arthropod species has increased from 0 to 11, amphibian species has increased from 6 to 7 species, reptile species has increased from 16 to 17 species, bird species has increased from 75 to 78 and mammal species has increased from 6 to 10. Though the species numbers have been continuously increasing however it is difficult to ascertain if it is due to improving habitat or regular systematic biodiversity study of the area.

  The Taloja Hills Field Guide which is an outcome of this exercise will provide excellent documentation of the hills and provide good educational resource for general public. Newspapers like Mid Day, Hindustan Times, Sakal have already published our stories on the field guide, this amplifies our reach.

- **Community Engagement & Awareness programmes**: We managed to engage the local community members in different activities like plantation, de-weeding, clean-ups, nursery work, seed collection and so on. The community members wanted us to conduct nature trails. This gives us enough hope that the community members will carry on the restoring work of the Taloja Hills.

- **Employee Engagement:** Due to several factors not enough events were conducted. However there is scope of employees volunteering at the Hills till monsoon.

- **Five-star system for evaluating system**: The International Principles and Standards for the Practice of Ecological Restoration (the Standards) presents a robust framework for restoration projects to achieve intended goals, while addressing challenges including effective design and implementation, accounting for complex ecosystem dynamics (especially in the context of climate change), and navigating trade-offs associated with land management priorities and decisions. The Standards highlight the role of ecological restoration in connecting social, community, productivity, and sustainability goals. As per the social five-star system for evaluating progress toward social goals in a restoration project or program this project can be rated as below.

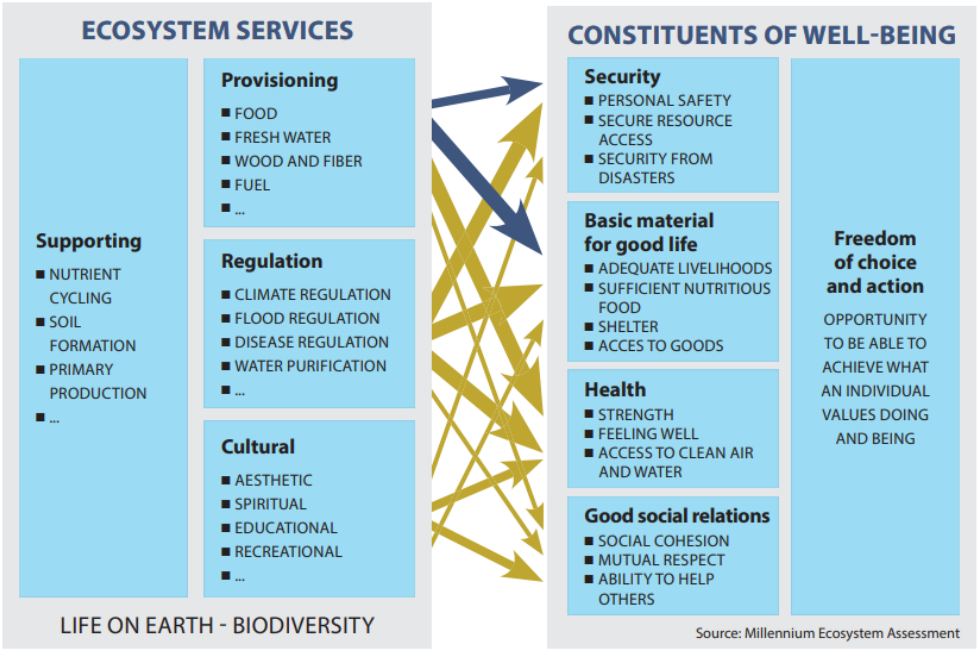


Goals	Rating	Comments
COMMUNITY WELLBEING		
Sense of place improved	4	Plantation has added greenery on the baren land
Social bonding improved	4	Bonds improved during volunteering events
Health and welfare improved	4	Plantation provides oxygen and fresh air. Also people use place for morning and evening walks.
STAKEHOLDER ENGAGEMENT		
Involvement attracted	4	Local community members are taking part in volunteering activities, keep watch on forest fires.
Support maintained	4	Support of local community members is maintained throughout the project period
Capacity increased	4	25 participants are trained under Naturalist training programme.
BENEFIT DISTRIBUTION		
Local Benefits Ensured	2	
Opportunity Equalized	2	
Cultures Conserved	0	
KNOWLEDGE ENRICHMENT		
Knowledge innovated	4	Field guides are developed from the biodiversity survey data collected
Science drawn upon	4	
TEK reinforced (Traditional Ecological Knowledge)	0	
RESTORING NATURAL CAPITAL		
Carbon Managed	2	The tree saplings have started storing carbon. Soil erosion was partially controlled saving soil carbon. Ground cover improved which also stores carbon.
Plant and Animal Conserved	4	Plantation is providing food and shelter to animals

		especially pollinators. Increase in plant and animal species.
Soil and Water repaired	3	Soil and Water test done shows improvement. Presence of Harvester Ants and Termites were seen.
SUSTAINABLE ECONOMICS		
Waste Circularized	3	Waste collected during clean-up drive is sent for recycling. Milk bags were used as sapling bags. Coconut shells were used for pathway edging.
Employment Generated	4	Local villagers are appointed as caretakers and also hired as labourers as and when required.
Eco-Business secured	0	
Total	52	
Percentage	**58%**	

- **Ecosystem services**: The Convention on Biological Diversity (1992) defines an ecosystem as "a complex of living organisms and the abiotic environment with which they interact in a specified location." Humankind and ecosystems are strongly interrelated in a multitude of ways. Direct and indirect benefits from ecosystems are known as ecosystem services. Forest ecosystem services (FES) are those services deriving from forest ecosystems.

  Some of these, such as recreation, relaxation, or shelter, are well appreciated by the general public, while some others are less understood, or simply taken for granted. The Millennium Ecosystem Assessment of 2005 defined ecosystem services as provisioning (food, water, wood, genetic resources), regulating (climate, floods, disease, water quality), cultural (recreation, spiritual benefits) and supporting (soil formation, primary production) (UNEP, 2005). Forests provide vital habitats for a multitude of animal and plant species, regulate water flow, protect water quality and supply clean air.



Source: Millennium Ecosystem Assessment. Ecosystems and Human Well-being. A synthesis. p.vi

Figure 41: Linkages between Ecosystem Services and Human Well-being.

The project site has started providing ecosystem services like

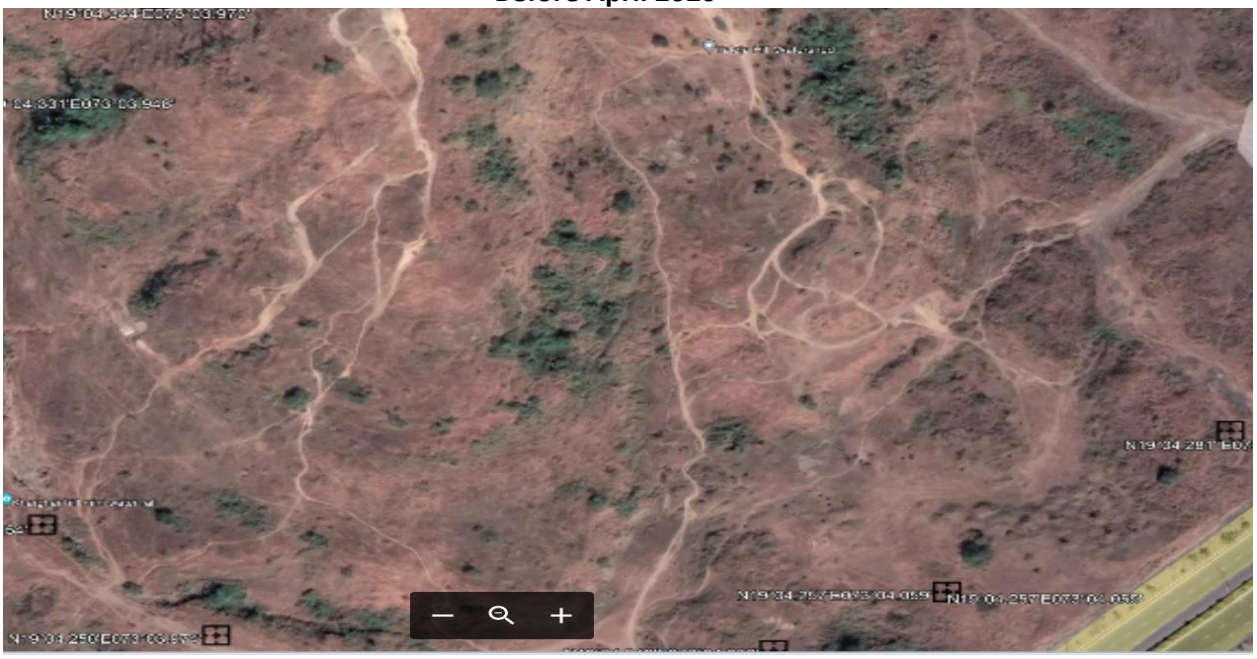
- Shelter and food for a number of insect and birdlife especially pollinators like bees, butterflies, moths, bats, birds and so on.
- Intervention techniques like contour bunding, check dam building and the ground cover plantation is helping in reducing the soil erosion and increasing water percolation. The plantation helps in stabilizing soil through complex root structures that reduce soil erosion, as well as improving water and nutrient infiltration and cycling.
- The tree saplings have started storing atmospheric carbon.
- The sapling planted produce oxygen and supply clean air
- Local community members are using the site for morning and evening walks, yoga and also for recreation on weekend and public holidays.
- With climate change a reality, powerful heatwaves are an issue of increasing concern in large cities. Once the plantation grows into Wooded 'green' area it will form a vital source of cooling. Awareness of the cooling effect of green areas is often low in the general public, and green city areas can be seen as a luxury or tourist amenity.

14. CONCLUSION

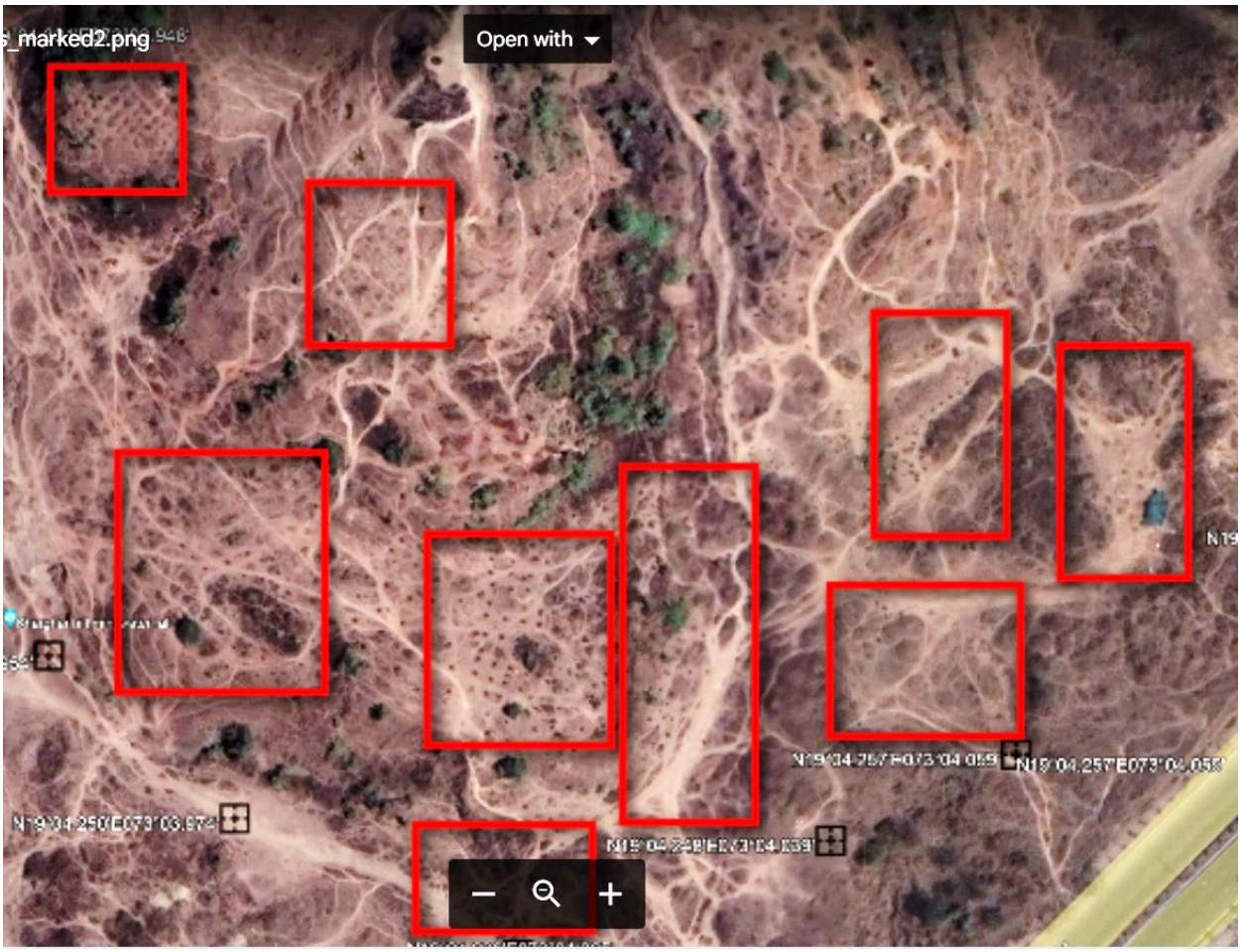
It was observed that 2873 plants are surviving at the site out of the 5435 saplings surviving in March 2022 and the compensatory plantation with a survival rate 52.8%. If compared with the poor soil soil condition, degraded habitat, forest fires, harsh weather, cattle grazing and other issues faced by the plantation then this is a good survival rate. Even the Forest Department has appreciated the same.

It was observed that the surviving saplings are growing well and are adding tiny green dots on the baren land which can be seen on the google earth images. Indicating that the baren land is slowly getting covered in the green. Some species have started flowering and fruiting like Indian Rosewood, and fever nut. Also the soil report indicates that the once acidic soil has become netural to slight alkaline.

Before April 2020



After March 2023



This concludes that the land that was once barren is getting successfully greened and improving. We have also noted a substantial increase in biodiversity observed at the site. In the last quarter however, plants suffered due to major forest fires and harsh weather and insect infestation. We had trouble employing caretakers at the site and hence had to hire labourers for site works. This quarter, we could not get a good response from the community and corporate volunteers. An increased awareness among the community was observed. Our volunteer base on social media is also rising as more and more people are proactively connecting with the project and we are hopeful for more such connections.

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Annexure 1: List of Plants Recorded During Survey

		April 2020	March 2021	Previous data (Mar22)	April 22-June22	July 22-Sep22	Oct22-Dec22	Jan 23-Feb 23
Sr. No.	**Type**	**Common Name**	**Common Name**	**Common Name**	**Common Name**	**Common Name**	**Common Name**	**Common Name**
1	Trees	Banyan Tree	Banyan Tree	Banyan Tree	Banyan Tree	Banyan Tree	Apta	Apta
2		Ambert Girchi	Ber	Ber	Ber	Ber	Bartondi	Asana
3		Ber	Black Ebony	Black Ebony	Black Ebony	Black Ebony	Ber	Ber
4		Dalbergia lanceolaria	Bridelia tomentosa	Bridelia tomentosa	Bridelia tomentosa	Bridelia tomentosa	Bridelia tomentosa	Dhaman
5		Dhaman	Broad-Leaved Coffee-Plum	Broad-Leaved Coffee-Plum	Broad-Leaved Coffee-Plum	Broad-Leaved Coffee-Plum	Dhaman	Flacourtia indica
6		Easter tree	Dalbergia	Camel's foot tree/Kanchan	Dalbergia	Camel's foot tree/Kanchan	Flacourtia indica	Flame of the Forest
7		East-Indian screw tree	Dhaman	Dalbergia	Dhaman	Dalbergia	Flame of the Forest	Ghost tree
8		Flame of the Forest	Easter tree	Dhaman	Easter tree	Dhaman	Ghost tree	Gliricidia
9		Indian Ash Tree	East-Indian screw tree	Easter tree	East-Indian screw tree	Easter tree	Gliricidia	Indian Charcoal tree
10		Indian Coral Tree	Flame of the Forest	East-Indian screw tree	Flame of the Forest	East-Indian screw tree	Indian Charcoal tree	Indian Elm tree
11		Indian Mulberry	Indian Ash Tree	Flame of the Forest	Indian Ash tree	Flame of the Forest	Indian Laburnum	Indian Laburnum
12		Indian Mulberry/ Bartondi	Indian Coral Tree	Indian Ash Tree	Indian Coral Tree	Indian Ash Tree	Shisham	Indian Mulberry
13		Indian rosewood	Indian Gooseberry	Indian Coral Tree	Indian Gooseberry	Indian Coral Tree	Jungle Cork Tree	Shisham
14		Karanj	Indian Laburnum	Indian Gooseberry	Indian Laburnum	Indian Gooseberry	Kakad	Kakad
15		Mountain Sweet Thorn	Indian Mulberry	Indian Laburnum	Indian Mulberry	Indian Laburnum	Kala Umber	Kala umber
16		Red Silk Cotton	Indian rosewood	Indian Mulberry	Khair	Indian Mulberry	Kanchan	Khair
17		Scholar's Tree	Jungle Cork Tree	Indian rosewood	Mountain Sweet Thorn	Indian rosewood	Khair	Neem Tree
18		Singapore Cherry	Kakad	Jungle Cork Tree	Neem Tree	Jungle Cork Tree	Neem Tree	Pongam tree
19		Sweet Indrajao	Kath Ber	Kakad	Pongam tree	Kakad	Pongam tree	Red Silk Cotton Tree

20		Tendu	Khair	Kath Ber	Red Silk Cotton Tree	Kath Ber	Red Silk Cotton Tree	Shirish
21		Wild Jamun	Mountain Sweet Thorn	Khair	Rohitaka	Khair	Shirish	Sweet Indrajao
22			Neem Tree	Mountain Sweet Thorn	Scholar's Tree	Mountain Sweet Thorn	Sweet Indrajao	Tetu
23			Pongam tree	Neem Tree	Singapore cherry	Neem Tree	Tetu	Umber
24			Red Silk Cotton Tree	Pongam tree	Sweet Indrajao	Pongam tree	Umber	Warras
25			Rohitaka	Red Silk Cotton Tree	Warras	Red Silk Cotton Tree	Warras	
26			Scholar's Tree	Rohitaka	Wild Jamun	Rohitaka		
27			Singapore cherry	Scholar's Tree		Scholar's Tree		
28			Sweet Indrajao	Singapore cherry		Singapore cherry		
29			Warras	Sweet Indrajao		Sweet Indrajao		
30			Wild Jamun	Warras		Warras		
31				Wild Jamun		Wild Jamun		
32	Shrubs	Ceylon caper	Fire Flame Bush	Ceylon caper	Ceylon caper	Ceylon caper	Giant Milk Weed	Giant Milk Weed
33		Blue Morning Glory	Flemingia sp	Christ's thorn	Christ's thorn	Christ's thorn	Christ's thorn	Christ's thorn
34		Christ's thorn	Giant Milk Weed	Common floss flower	Fire Flame Bush	Giant Milk Weed	Common floss flower	Common floss flower
35		Fire Flame Bush	Green milkweed climber	Common mallow	Giant Milk Weed	Green milkweed climber	Cocculus hirsutus	
36		Giant Milk Weed	Ixora	Elephant creeper	Green milkweed climber	Ixora	White berry	
37		Ixora	Karavi	Fire Flame Bush	Ixora	Karavi	Railway Creeper	
38		Malabar Madhu Malati	Malabar Madhu Malati	Flemingia sp	Karavi	Malabar Madhu Malati	Wild Jasmine	
39		Paper Flower Climber	Paper Flower Climber	Giant Milk Weed	Malabar Madhu Malati	Paper Flower Climber		
40		Wattakaka volubilis	Showy Rattlepod	Green milkweed climber	Paper Flower Climber	Showy Rattlepod		
41		Wild Caper Bush	Sunset Muskmallow	Holostemma creeper		Spiny Gourd		
42			Tuberculated Mallow	Industrial hemp		Woodrow's grape trèe		

43			Woodrow's grape trèe	Ixora				
44				Karavi				
45				Malabar Madhu Malati				
46				Spiny Gourd				
47				Paper Flower Climber				
48				Showy Rattlepod				
49				Sunset Muskmallow				
50				Transparent Wood Rose				
51				Tuberculated Mallow				
52				White berry				
53				Woodrow's grape trèe				
54	Herbs	Wild Banana	American catmint	Adder's tongue	American catmint	American mint	Hairy Okra	American mint
55		East Indian Globe thistle	Asian spider flower	American catmint	Bamboo	Bamboo	Alysicarpus vaginalis	Aplunda mutica
56		Hill Gynura	Bamboo	American mint	Bile killer	Bile killer	American mint	Bermuda grass
57		Madras Carpet	Bile killer	Asian spider flower	Blue Morning Glory	Blue Morning Glory	Aplunda mutica	Bhamburda
58		Mexican Mint	Blue Morning Glory	Bamboo	Coat Button	Coat Button	Blumea lacera	Chiman chara
59		Wild Spider Flower	Blumea oxyodenta	Bile killer	Common cow itch	Common balsam	Canscora diffusa	Comb rungia
60		Quickweed	Brazilian Jute	Blue Morning Glory	Common Purple Mallow	Common cow itch	Cenchrus spp	Ekdandi
61		Van bhendi	Clasping leaf Borage	Brazilian Jute	Crab's eye creeper	Common Purple Mallow	Coat Button	Kate adulsa
62		Wild Grape	Coat Button	Bryophyllum	Dwarf Morning Glory	Common Sopubia	Crotalaria filipes	Kilwar
63			Common balsam	Clasping leaf Borage	East Indian Globe thistle	Crab's eye creeper	Cyathocline purpurea	Silver spiked Cockscomb
64			Common cow itch	Coat Button	Edible Chlorophytum	Dragon stalk yam	Dactylotenium	Pin cusion
65			Common Fringed Flowervine	Cocks comb	Hill tumeric	Dwarf Morning Glory	Eleusine indica	Pseudanthistiria spp

66			Common Purple Mallow	Common balsam	Indian borage	East Indian Globe thistle	Eragrostis uniloides	Ran Aboli
67			Common Sopubia	Common cow itch	Mexican Mint	Edible Chlorophytum	Erathemum roseum	Wild banana
68			Common spurge	Common Fringed Flowervine	Pin cushion	Hill turmeric	Frilly Lepidagathis	Ranbhendi
69			Crab's eye creeper	Common Purple Mallow	Pot Cassia	Indian borage	Justicia pectinata	
70			Creeping Tick Trefoil	Common Sopubia	Rattlepod	Little Persian Violet	Lucas aspera	
71			Desmodium	Common spurge	Silver spiked Cockscomb	Mexican Mint	Pseudanthistiria spp	
72			Devil's claw	Crab's eye creeper	Spiny melon	Oriental sesame	Silver spiked Cockscomb	
73			Dragon stalk yam	Creeping Tick Trefoil	Sweet broom weed	Panicled Dewflower	Themeda triandra	
74			Dwarf Morning Glory	Desmodium	Tiny Morning Glory	Pin cushion	Wild banana	
75			Dwarf Reedgrass	Devil's claw	Transparent Wood Rose	Pot Cassia		
76			East Indian Globe thistle	Dragon stalk yam	Van bhendi	Rattlepod		
77			Edible Chlorophytum	Dwarf Morning Glory	Wild banana	Silver spiked Cockscomb		
78			Feotid star violet	Dwarf Reedgrass	Wild Grape	Spiny melon		
79			Forest spider lily	East Indian Globe thistle	Yellow ground star	Sweet broom weed		
80			Frilly Lepidagathis	Edible Chlorophytum		Tiny Morning Glory		
81			Glorry	Feotid star violet		Transparent Wood Rose		
82			Glory lily	Forest spider lily		Van bhendi		
83			Graham's groundsel	Frilly Lepidagathis		Wild banana		
84			Hairy Okra	Glorry		Wild Grape		
85			Hill Gynura	Glory lily		Yellow ground star		
86			Hill tumeric	Gomphrena Flower				

87			Indian borage	Graham's groundsel				
88			Indian Sarsaparilla	Hairy Okra				
89			Indian Spur-Anther Flower	Hill Gynura				
90			Indian Squill	Hill tumeric				
91			Justacia	Indian borage				
92			Lanceleaf Alyce clover	Indian Sarsaparilla				
93			Law's fimbry	Indian Spur-Anther Flower				
94			Lesser mallow white	Indian Spurge Tree				
95			Ludwigia	Indian Squill				
96			Madras Carpet	Justacia				
97			Madras pea pumpkin	Lanceleaf Alyce clover				
98			Marsh Barbel	Law's fimbry				
99			Mexican Mint	Lesser mallow white				
100			Narrowleaf Indigo	Ludwigia				
101			Oriental sesame	Madras Carpet				
102			Panicled Dewflower	Madras pea pumpkin				
103			Pin cushion	Marsh Barbel				
104			Pink striped trumpet lily	Mexican Mint				
105			Pot Cassia	Narrowleaf Indigo				
106			Prickly Amaranth	Oriental sesame				
107			Quickweed	Panicled Dewflower				
108			Railway Creeper	Pin cushion				
109			Rattlepod	Pink striped trumpet lily				
110			Sal leaved desmodium	Pot Cassia				
111			Scorpion Tick Trefoil	Prickly Amaranth				
112			Showy Pigeonpea	Quickweed				
113			Silver spiked Cockscomb	Railway Creeper				
114			Sonkadi	Rattlepod				

115			Spiny melon	Sal leaved desmodium				
116			Spreading Canscora	Sap kanda				
117			Sweet broom weed	Scorpion Tick Trefoil				
118			Tangle mat	Sesame				
119			Tiny Morning Glory	Showy Pigeonpea				
120			Transparent Wood Rose	Showy Rattlepod				
121			Van bhendi	Sickle senna				
122			Van bhendi	Silver spiked Cockscomb				
123			Western Hill Catmint	Sonkadi				
124			Whiskered Spider Flower	Spiny Leaved Blume a				
125			Wild banana	Spiny melon				
126			Wild Grape	Spreading Canscora				
127			Wild Spider Flower	Sundew plant				
128			Yellow berried nightshade	Sweet broom weed				
129			Yellow ground star	Tangle mat				
130				Tiny Morning Glory				
131				Transparent Wood Rose				
132				Tutari				
133				Unid Grass				
134				Van bhendi				
135				Water willow				
136				Western Hill Catmint				
137				Whiskered Spider Flower				
138				Wild banana				
139				Wild Grape				
140				Wild Senna				
141				Wild Spider Flower				
142				Yellow berried nightshade				
143				Yellow ground star				

Annexure 2: Total List of Plants from Plant Survey

Sr. No.	Type	Common Name
1	Trees	Apta
2		Asana
3		Banyan Tree
4		Bartondi
5		Ber
6		Black Ebony
7		Bridelia tomentosa
8		Broad-Leaved Coffee-Plum
9		Camel's foot tree/Kanchan
10		Dalbergia
11		Dhaman
12		Easter tree
13		East-Indian screw tree
14		Flacourtia indica
15		Flame of the Forest
16		Ghost tree
17		Gliricidia
18		Indian Ash Tree
19		Indian Charcoal tree
20		Indian Coral Tree
21		Indian Elm tree
22		Indian Gooseberry
23		Indian Laburnum
24		Indian Mulberry
25		Indian rosewood
26		Jungle Cork Tree
27		Kakad
28		Kala Umber
29		Kath Ber
30		Khair
31		Mountain Sweet Thorn
32		Neem Tree
33		Pongam tree
34		Red Silk Cotton Tree
35		Rohitaka
36		Scholar's Tree
37		Shirish
38		Shisham
39		Singapore cherry
40		Sweet Indrajao
41		Tetu

42		Umber
43		Warras
44		Wild Jamun
45	Shrubs	Ceylon caper
46		Christ's thorn
47		Common floss flower
48		Common mallow
49		Elephant creeper
50		Fire Flame Bush
51		Flemingia sp
52		Giant Milk Weed
53		Green milkweed climber
54		Holostemma creeper
55		Industrial hemp
56		Ixora
57		Karavi
58		Malabar Madhu Malati
59		Spiny Gourd
60		Paper Flower Climber
61		Showy Rattlepod
62		Sunset Muskmallow
63		Transparent Wood Rose
64		Tuberculated Mallow
65		White berry
66		Woodrow's grape trèe
67		Cocculus hirsutus
68		Wild Jasmine
69	Herbs	Adder's tongue
70		Alysicarpus vaginalis
71		American catmint
72		American mint
73		Aplunda mutica
74		Asian spider flower
75		Bamboo
76		Bile killer
77		Blue Morning Glory
78		Blumea lacera
79		Brazilian Jute
80		Bryophyllum
81		Canscora diffusa
82		Cenchrus spp
83		Clasping leaf Borage
84		Coat Button

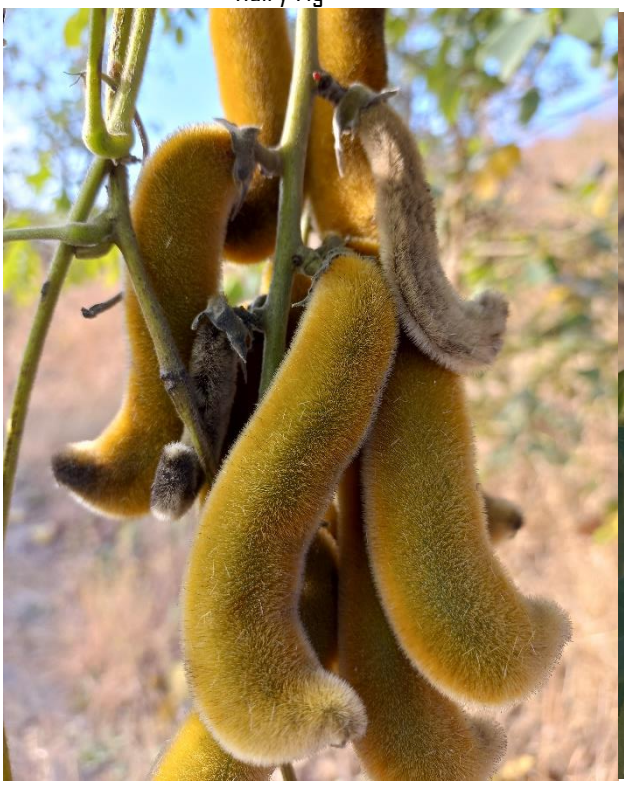
85		Common balsam
86		Common cow itch
87		Common Fringed Flowervine
88		Common Purple Mallow
89		Common Sopubia
90		Common spurge
91		Crab's eye creeper
92		Creeping Tick Trefoil
93		Crotalaria filipes
94		Cyathocline purpurea
95		Dactylotenium
96		Desmodium
97		Devil's claw
98		Dragon stalk yam
99		Dwarf Morning Glory
100		Dwarf Reedgrass
101		East Indian Globe thistle
102		Edible Chlorophytum
103		Eleusine indica
104		Eragrostis uniloides
105		Erathemum roseum
106		Feotid star violet
107		Forest spider lily
108		Frilly Lepidagathis
109		Glorry
110		Glory lily
111		Gomphrena Flower
112		Graham's groundsel
113		Hairy Okra
114		Hill Gynura
115		Hill tumeric
116		Indian borage
117		Indian Sarsaparilla
118		Indian Spur-Anther Flower
119		Indian Spurge Tree
120		Indian Squill
121		Justacia
122		Justicia pectinata
123		Lanceleaf Alyce clover
124		Law's fimbry
125		Lesser mallow white
126		Lucas aspera
127		Ludwigia
128		Madras Carpet
129		Madras pea pumpkin
130		Marsh Barbel
131		Mexican Mint

132		Narrowleaf Indigo
133		Oriental sesame
134		Panicled Dewflower
135		Pin cushion
136		Pink striped trumpet lily
137		Pot Cassia
138		Prickly Amaranth
139		Pseudanthistiria spp
140		Quickweed
141		Railway Creeper
142		Rattlepod
143		Sal leaved desmodium
144		Sap kanda
145		Scorpion Tick Trefoil
146		Sesame
147		Showy Pigeonpea
148		Showy Rattlepod
149		Sickle senna
150		Silver spiked Cockscomb
151		Sonkadi
152		Spiny Leaved Blumea
153		Spiny melon
154		Spreading Canscora
155		Sundew plant
156		Sweet broom weed
157		Tangle mat
158		Themeda triandra
159		Tiny Morning Glory
160		Transparent Wood Rose
161		Tutari
162		Unid Grass
163		Van bhendi
164		Water willow
165		Western Hill Catmint
166		Whiskered Spider Flower
167		Wild banana
168		Wild Grape
169		Wild Senna
170		Wild Spider Flower
171		Yellow berried nightshade
172		Yellow ground star

Annexure 3: Floral diversity at the site

Hairy Fig

Khair



Common cowitch

Castor

Silver spike cock's comb

Common Purple Mallow

Lesser white mallow

Kumbhi

Pongam

Easter Flower tree

Laburnum

Grevia

Annexure 4: List of Insects Observed at site

Sr. No.	Group	April 2020	March 2021	Previous data (Mar22)	Apr-Jun22	July 22-Sep22	Oct 22-Dec 22	Jan23- Mar 23
1	Ants, Bees, Wasps	Harvester Ant Hill	Anthrax Beefly	Anthrax Beefly		Honey bee	Carpenter bee	Carpenter bee
2		Carpenter Bee	Carpenter Bee	Carpenter bee			Harvester Ant Hill	Harvester Ant Hill
3			Digger bee	Digger bee			Honey bee	Mud dauber wasp
4			Digger wasp	Digger wasp				Honey bee
5			Harvester Ant Hill	Harvester Ant Hill				Papper Wasp
6			Honey bee	Honey bee				
7				Paper Wasp				
8	Beetles	Tortoise Shell beetle	Flower Chafer	Flower Chafer		Jewel beetle	Ladybird beetle	Darkling beetle
9			Tortoise Shell beetle	Jewel Beetle				Stem borer
10			Weevil	Tortoise Shell beetle				Ladybird beetle
11								
12				Weevil				
13	Bugs	Spittle Bug	Plant bugs	Plant bugs			Aphid	Aphid
14			Spittle Bug	Spittle bug			Shield bug	Leaf hopper
15				Shield bug			*Eurybrachys tomentosa*	Mealybug
16							Leaf hopper	Red cotton silk bug
17								Shield bug
18								Stink bug
19	Butterflies & Moths	Blue tiger	Blue tiger	Albatross	Common Albatross	Baronet	Baronet	Blue Pansy
20		Common Crow	Common Crow	Arcuate Passenger moth	Common rose	Blue tiger	Blue Pansy	Blue Tiger
21		Common Jezebel	Common Emigrant	Blue Spotted Forester Moth	Striped tiger butterfly	Common Crow	Blue Tiger	Common Baronet
22		Common Rose	Common Jezebel	Blue tiger	Peacock Pansy	Common Emigrant	Chocolate Pansy	Common Crow
23		Glassy Tiger	Common nawab	Common castor		Common leopard	Common Crow	Common Emigrant
24		Red Helen	Common Rose	Common Crow		Common Rose	Common Emigrant	Common Grass Yellow
25		Tiger Moth Caterpillar	Common sailer	Common Emigrant		Common Wanderer	Common grass yellow	Common Jezebel

26		Tussock Moth caterpillar	Common Wanderer	Common evening brown caterpillar		Danaid eggfly	Common Mormon	Common Leopard
27			Danaid eggfly	Common Jezebel		Grass Yellow	Common Wanderer	Common Lineblue
28			Emigrant	Common Mormon		Great eggfly	Dark grass blue	Common Rose
29			Glassy Tiger	Common nawab		Trabala vishnou caterpillar	Gram blue	Common sailor
30			Gram blue	Common Rose		Owlet moth	Lemon Pansy	Forget me-not
31			Grass Yellow	Common sailer		Plain tiger	Peacock Pansy	Geometer moth
32			Grey pansy	Common Wanderer		Striped tiger	Plain Tiger	Gram Blue
33			Lime butterfly caterpillar	Danaid eggfly			Sailor	Grass Jewel
34			Plain Tiger	Glassy Tiger			Small grass jewel	Grass moth
35			Red Helen	Gram blue			Spotted Small Flat	Lappet Moth
36			Skipper	Grass Yellow			Striped tiger	Lemon Pansy
37			Striped tiger	Grey pansy			Trabala vishnou caterpillar	Pecock Pansy
38			Tawny Coster	Hummingbird hawkmoth caterpillar			Bagworm moth	Plain Tiger
39			Hummingbird hawkmoth caterpillar	Karvanda Hawkmoth egg				Psyche
40			Karvanda Hawkmoth egg	Lemon Pansy				Rounded Pierro
41			Tasar silk moth cocoon	Levant Hawkmoth				Salmon Arab
42			Tiger Moth Caterpillar	Lime butterfly				Tawny Coster
43			Tussock Moth caterpillar	Lime butterfly caterpillar				Tribala Vishnou
44				Plain Barrow moth				White Orange Tip
45				Plain Tiger				
46				Red Helen				
47				Rustic				
48				Skipper				

49				Striped tiger				
50				Tasar silk moth cocoon				
51				Tawny Coster				
52				Tawny Coster				
53				Tiger Moth Caterpillar				
54				Un id Moth				
55				Yellow orange tip				
56				Yellow Underwing Tiger Moth				
57	Dragonflies & Damselflies		Red dragonfly	Red dragonfly		Dragonfly Unidentified	Red dragonfly	Red dragonfly
58				Dragonfly Unidentified				Blue Damselfly
59				Blue Damselfly				
60	Grasshoppers		Bush cricket	Bush cricket	Hooded grasshopper	Painted grasshopper	Hooded grasshopper	Painted grasshopper
61			Painted grasshopper	Painted grasshopper	Painted grasshopper		Painted grasshopper	Pygmy Grasshopper
62			Pygmy Grasshopper	Pygmy Grasshopper			Short horned grasshopper	Short horned grasshopper
63				Schistocerca sp.				
64	Lacewings/ Antlions		Spotted wing Ant lion	Spotted wing Ant lion				Spotted wing Ant lion
65	True Flies		Robberfly	Robberfly			Robberfly	Crane fly
66								Robberfly
67	Termite							Termite nest
68	Others	Plant Galls	Plant Galls	Plant Galls			Bark Mantis	Bark mantis
69				Bark Mantis			Praying Mantis	Praying Mantis
70								
71	Arachnids				Wolf spider	Unidentified spider	Grass lynx spider	Ant mimic spider
72					Unidentified spider		Oxyopes javanus	Oxyopes javanus
73					Hetrometrus sp. (Scorpion),		Oxyopes salticus	Signature Spider
74							Oxypoes birmanicus	
75							Signature Spider	
76							Two stripped	

							jumping spider	

Annexure 5: Total Insect list seen at site

Sr.No.	Group	Total
1	Ants, Bees, Wasps	Anthrax Beefly
2		Carpenter bee
3		Digger bee
4		Digger wasp
5		Harvester Ant Hill
6		Honey bee
7		Mud dauber wasp
8		Papper Wasp
9	Beetles	Flower Chafer
10		Jewel Beetle
11		Tortoise Shell beetle
12		Weevil
13		Ladybird beetle
14		Darkling beetle
15		Stem borer
16	Bugs	Aphid
17		*Eurybrachys tomentosa*
18		Leaf hopper
19		Mealybug
20		Plant bugs
21		Red cotton silk bug
22		Shield bug
23		Spittle bug
24		Stink bug
25	Butterflies & Moths	Albatross
26		Arcuate Passenger moth
27		Bagworm moth
28		Baronet
29		Blue Pansy
30		Blue Spotted Forester Moth
31		Blue tiger
32		Chocolate Pansy
33		Common castor
34		Common Crow
35		Common Emigrant
36		Common evening brown caterpillar
37		Common grass yellow
38		Common Jezebel
39		Common leopard
40		Common Lineblue
41		Common Mormon

42		Common nawab
43		Common Rose
44		Common sailer
45		Common Wanderer
46		Danaid eggfly
47		Dark grass blue
48		Forget me-not
49		Geometer moth
50		Glassy Tiger
51		Gram blue
52		Grass Jewel
53		Grass moth
54		Grass Yellow
55		Great eggfly
56		Grey pansy
57		Hummingbird hawkmoth caterpillar
58		Karvanda Hawkmoth egg
59		Lappet Moth
60		Lemon Pansy
61		Levant Hawkmoth
62		Lime butterfly
63		Owlet moth
64		Peacock Pansy
65		Plain Barrow moth
66		Plain Tiger
67		Psyche
68		Red Helen
69		Rounded Pierro
70		Rustic
71		Sailor
72		Salmon Arab
73		Skipper
74		Small grass jewel
75		Spotted Small Flat
76		Striped tiger
77		Tasar silk moth cocoon
78		Tawny Coster
79		Tiger Moth Caterpillar
80		Trabala vishnou
81		Un id Moth
82		White Orange Tip
83		Yellow orange tip
84		Yellow Underwing Tiger Moth

85	Dragonflies & Damselflies	Red dragonfly
86		Dragonfly Unidentified
87		Blue Damselfly
88	Grasshoppers	Bush cricket
89		Hooded grasshopper
90		Painted grasshopper
91		Pygmy Grasshopper
92		Schistocerca sp.
93		Short horned grasshopper
94	Lacewings/ Antlions	Spotted wing Ant lion
95	True Flies	Crane fly
96		Robberfly
97	Termite	Termite
98	Others	Bark Mantis
99		Plant Galls
100		Praying Mantis
101	Arachnids	Grass lynx spider
102		Ant mimic spider
103		Hetrometrus sp. (Scorpion),
104		Oxyopes javanus
105		Oxyopes salticus
106		Oxypoes birmanicus
107		Signature Spider
108		Two stripped jumping spider
109		Unidentified spider
110		Unidentified spider 2
111		Wolf spider

Annexure 6: Representative Insect Photographs

Leaf Hopper

Plain tiger butterfly caterpillar

Bag worm moth

Jumping Spider

Plain tiger butterfly pupa

Common Baronet

Harvester Ant Hill

Rounded pierrot

Lappet moth caterpillar

Sternocera chrysis

Mantis

Common Rose

Aphids on Gliricidia tree

Grass Moth

Tassar silk moth cucoon

Emigrant Butterfly caterpillar

Gram Blue

Lemon Pansy

Plain Tiger

Oxyopes birmanicus

Oxyopes javanus

Oxyopes salticus

Annexure 7: List of Herpetofauna

Sr.No.	Group	Total Sightings	April 2020	March 2021	Previous data (Mar22)	Apr-Jun22	July 22-Sep22	Oct 22-Dec 22	Jan2 Mar
1	Reptiles	Bark Gecko	Oriental Garden lizard	Keeled mabuya skink	Keeled mabuya skink	Rat Snake	Keeled mabuya skink	Bark Gecko	Keel mab skin
2		Brook's Gecko		Common Cobra	Brook's Gecko	Keeled mabuya skink	Chameleon	Keeled mabuya skink	Orie Garc lizar
3		Chameleon		Common Gecko	Chameleon	Monitor lizard	Common Gecko	Russell's Viper	Broo Gec
4		Checkered Keelback snake		Chameleon	Checkered Keelback snake	Oriental Garden lizard	Oriental Garden lizard	Oriental Garden lizard	Rat Snak
5		Common Cobra		Fan Throated Lizard	Common Cobra	Russell's Viper			Fore calo
6		Common Gecko		Oriental Garden lizard	Common Gecko				
7		Fan Throated Lizard		Rat Snake	Fan Throated Lizard				
8		Forest calotes		Sand Boa	Keeled mabuya skink				
9		Keeled mabuya skink		Wolf Snake	Lined Supple Skink				
10		Lined Supple Skink			Monitor Lizard				
11		Monitor Lizard			Oriental Garden Lizard				
12		Oriental Garden lizard			Rat Snake				
13		Rat Snake			Russell's kukri				
14		Russell's kukri			Russell's Viper				
15		Russell's Viper			Sand Boa				
16		Sand Boa			Wolf Snake				
17		Wolf Snake							
18	Amphibians	Asian Common Toad		Cricket Frog	Burrowing Frog	Cricket Frog	Common Tree Frog		Asia Com Toac
19		Burrowing Frog		Indian Bull Frog	Common Tree Frog				
20		Common Tree Frog		Un id tadpoles	Cricket Frog				
21		Cricket Frog			Indian Bull Frog				

22		Indian Bull Frog			Skittering Frog				
23		Skittering Frog			Un id tadpoles				
24		Un id tadpoles							

Annexure 8: Representative Photographs of Herpetofauna

Oriental Garden Lizard

Brahmini skink

Annexure 9: List of Birds

Sr. No.	Total	April 2020	March 2021	Previous data (Mar22)	Apr-Jun22	July 22-Sep22	Oct 22 - Dec 22	Jan23-Mar 23
1	Alexandrine Parakeet	Ashy Prinia	Alexandrine Parakeet	Alexandrine Parakeet	Ashy Prinia	Ashy Prinia	Ashy Drongo	Ashy Prinia
2	Ashy Drongo	Asian Koel	Ashy Drongo	Ashy Drongo	Black Kite (Black)	Asian Koel	Ashy Prinia	Asian Koel
3	Ashy Prinia	Asian Openbill	Ashy Prinia	Ashy Prinia	Common Myna	Asian Palm-swift	Asian Koel	Barn Owl
4	Asian Koel	Asian Palm Swift	Asian Koel	Asian Koel	Common Tailorbird	Asian pied starling	Black Kite (Black)	Black Kite (Black)
5	Asian Openbill	Asian Pied Starling	Asian Openbill	Asian Openbill	House Crow	Black Kite	Bluethroat	Booted Eagle
6	Asian Palm Swift	Barred Buttonquail	Asian Palm Swift	Asian Palm Swift	Indian Robin	Cattle Egret	Blyth's Reed Warbler	Cattle Egret
7	Asian Pied Starling	Black Kite	Asian Pied Starling	Asian Pied Starling	Little Cormorant	Common myna	Cattle Egret	Common Myna
8	Barn Owl	Cattle Egret	Barn Swallow	Barn Swallow	Long-tailed Shrike	Common tailorbird	Common Myna	Greater Coucal
9	Barn Swallow	Common Iora	Barred Buttonquail	Barred Buttonquail	Red-vented Bulbul	Coppersmith barbet	Common Tailorbird	Green Bee-eater
10	Barred Buttonquail	Common Kingfisher	Black Kite (Black)	Black Kite (Black)	Red-whiskered Bulbul	Green Bee-eater	Coppersmith Barbet	House Crow
11	Black Kite (Black)	Common Myna	Black Kite (Black-eared)	Black Kite (Black-eared)	White-throated Kingfisher	House crow	Green Bee-eater	House Sparrow
12	Black Kite (Black-eared)	Common Pigeon	Black neck Bunting	Black neck Bunting		House sparrow	House Crow	Indian Golden Oriole
13	Black neck Bunting	Common Tailorbird	Blyth's Reed Warbler	Black-winged Kite		Indian Pond Heron	House Sparrow	Indian Robin
14	Black-winged Kite	Dusky Crag Martin	Booted Eagle	Blyth's Reed Warbler		Indian Robin	Indian Pond-Heron	Large-billed Crow (Indian Jungle)
15	Bluethroat	Green Bee-eater	Booted Warbler	Booted Eagle		Intermediate Egret	Indian Robin	Little Cormorant
16	Blyth's Reed Warbler	Grey-bellied Cuckoo	Brown Rock Chat	Booted Warbler		Large-billed crow	Large-billed Crow	Long-tailed Shrike
17	Booted Eagle	Grey-breasted Prinia	Buttonquail sps	Brown Rock Chat		Laughing Dove	Laughing Dove	Oriental Magpie-Robin
18	Booted Warbler	House Crow	Cattle Egret	Buttonquail sps		Little cormorant	Little Cormorant	Pale-billed Flowerpecker
19	Brown Rock Chat	House Sparrow	Common Iora	Cattle Egret		Oriental Magpie Robin	Long-tailed Shrike	Plain Prinia
20	Buttonquail sps	Indian Blackbird	Common Kingfisher	Common Iora		Pale billed flowerpecker	Oriental Magpie-Robin	Purple Sunbird
21	Cattle Egret	Indian Jungle Crow	Common Myna	Common Kingfisher		Plain Prinia	Plain Prinia	Purple-rumped Sunbird
22	Common Iora	Indian Pond Heron	Common Tailorbird	Common Myna		Red vented bulbul	Purple-rumped Sunbird	Red-vented Bulbul
23	Common Kingfisher	Indian Robin	Coppersmith Barbet	Common Tailorbird		Red whiskered bulbul	Red-vented Bulbul	Red-wattled Lapwing

24	Common Myna	Laughing Dove	Dusky Crag-Martin	Coppersmith Barbet		Rock piegeon	Red-wattled Lapwing	Red-whiskered Bulbul
25	Common Tailorbird	Little Swift	Gray-breasted Prinia	Dusky Crag-Martin		Rose ringed parakeet	Rock Pigeon (Feral Pigeon)	Rock Pigeon (Feral Pigeon)
26	Coppersmith Barbet	Plain Prinia	Green Bee-eater	Gray-breasted Prinia		Scaly breasted Munia	Rose-ringed Parakeet	Rose-ringed Parakeet
27	Dusky Crag-Martin	Purple Sunbird	Grey-bellied Cuckoo	Greater Coucal (Southern)		Spotted dove	Scaly-breasted Munia	Siberian Stonechat
28	Gray-breasted Prinia	Red-vented Bulbul	Grey-breasted Prinia	Green Bee-eater		White throated kingfisher	Siberian Stonechat	White throated Kingfisher
29	Greater Coucal (Southern)	Red-wattled Lapwing	House Crow	Grey-bellied Cuckoo		Yellow eyed babbler	Spotted Dove	Wire-tailed Swallow
30	Green Bee-eater	Red-whiskered Bulbul	House Sparrow	Grey-breasted Prinia		Zitting Cisticola	White-throated Kingfisher	
31	Grey-bellied Cuckoo	Scaly-breasted Munia	Indian Blackbird	House Crow			Wire-tailed Swallow	
32	Grey-breasted Prinia	Spotted Dove	Indian Golden Oriole	House Sparrow			Zitting Cisticola	
33	House Crow	White-throated Kingfisher	Indian Pond Heron	Indian Blackbird				
34	House Sparrow	Yellow-eyed Babbler	Indian Robin	Indian Golden Oriole				
35	Indian Blackbird		Jungle Bush-Quail	Indian Pond Heron				
36	Indian Golden Oriole		Jungle Prinia	Indian Robin				
37	Indian Pond Heron		Large-billed Crow (Indian Jungle)	Jungle Bush-Quail				
38	Indian Robin		Laughing Dove	Jungle Prinia				
39	Intermediate Egret		Lesser Coucal	Large-billed Crow (Indian Jungle)				
40	Jungle Bush-Quail		Little Cormorant	Laughing Dove				
41	Jungle Prinia		Little Swift	Lesser Coucal				
42	Large-billed Crow (Indian Jungle)		Long-tailed Shrike	Little Cormorant				
43	Laughing Dove		Montagu's Harrier	Little Swift				
44	Lesser Coucal		Oriental Magpie-Robin	Long-tailed Shrike				

45	Little Cormorant		Paddyfield Warbler	Montagu's Harrier				
46	Little Swift		Painted Stork	Oriental Magpie-Robin				
47	Long-tailed Shrike		Pale-billed Flowerpecker	Paddyfield Pipit				
48	Montagu's Harrier		Peregrine Falcon (Shaheen)	Paddyfield Warbler				
49	Oriental Magpie-Robin		Plain Prinia	Painted Francolin				
50	Paddyfield Pipit		Purple Heron	Painted Stork				
51	Paddyfield Warbler		Purple Sunbird	Pale-billed Flowerpecker				
52	Painted Francolin		Purple-rumped Sunbird	Peregrine Falcon (Shaheen)				
53	Painted Stork		Red Avadavat	Plain Prinia				
54	Pale-billed Flowerpecker		Red-rumped Swallow	Purple Heron				
55	Peregrine Falcon (Shaheen)		Red-vented Bulbul	Purple Sunbird				
56	Plain Prinia		Red-wattled Lapwing	Purple-rumped Sunbird				
57	Purple Heron		Red-whiskered Bulbul	Red Avadavat				
58	Purple Sunbird		Rock Pigeon (Feral Pigeon)	Red-rumped Swallow				
59	Purple-rumped Sunbird		Rose-ringed Parakeet	Red-vented Bulbul				
60	Red Avadavat		Rufous-tailed Lark	Red-wattled Lapwing				
61	Red-rumped Swallow		Scaly-breasted Munia	Red-whiskered Bulbul				
62	Red-vented Bulbul		Shikra	Rock Pigeon (Feral Pigeon)				
63	Red-wattled Lapwing		Siberian Stonechat	Rose-ringed Parakeet				
64	Red-whiskered Bulbul		Spot-breasted Fantail	Rufous-tailed Lark				
65	Rock Pigeon (Feral Pigeon)		Spotted Dove	Scaly-breasted Munia				
66	Rose-ringed Parakeet		Tree Pipit	Shikra				

67	Rufous-tailed Lark		White-throated Kingfisher	Siberian Stonechat				
68	Scaly-breasted Munia		Wire-tailed Swallow	Spot-breasted Fantail				
69	Shikra		Yellow-eyed Babbler	Spotted Dove				
70	Siberian Stonechat		Yellow-throated Sparrow	Tree Pipit				
71	Spot-breasted Fantail		Zitting Cisticola	White-throated Kingfisher				
72	Spotted Dove			Wire-tailed Swallow				
73	Tree Pipit			Yellow-eyed Babbler				
74	White-throated Kingfisher			Yellow-throated Sparrow				
75	Wire-tailed Swallow			Zitting Cisticola				
76	Yellow-eyed Babbler							
77	Yellow-throated Sparrow							
78	Zitting Cisticola							

Annexure 10: Representative Bird Photographs

Greater Coucal

Common Myna

Red-vented Bulbul

Ashy Prinia

Purple Sunbird

Pale Billed Flowerpecker

Wire-tailed Swallow

Booted Eagle

Annexure 11: List of Mammals observed at site

Sr. No.	Total	April 2020	March 2021	Previous data (Mar22)	Apr-Jun22	July 22-Sep22	Oct 22 - Dec 22	Jan23-Mar 23
1	Black-naped hare			Black-naped hare	Cow	Black-naped hare	Black-naped hare (droppings)	Black-naped hare (droppings)
2	Cow			Flying Fox	Dog(feral)	Cow	Buffalo	Cow
3	Dog(feral)			Gerbil	Goat	Dog(feral)	Goat	Dog(feral)
4	Flying Fox			Indian Grey Mongoose		Goat		Buffalo
5	Gerbil			Palm Squirrel		Palm squirrel		Palm squirrel
6	Goat			Unidentified Forest Shrew				
7	Indian Grey Mongoose							
8	Palm Squirrel							
9	Unidentified Forest Shrew							
10	Buffalo							

Annexure 12: Photographs of Mammals observed at site

Buffalo

Droppings of Hare

Annexure 13: Soil and Water Test

SIES (Nerul) College of Arts, Science & Commerce
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April 13, 2023

SOIL ANALYSIS REPORT

Sample 01 (Area: Taloja)

Sr.No.	Parameters	Sample Reading	Standard Metrics
1.	pH	7.60	pH meter
2.	Conductivity	0.053 micro Siemens/cm	Conductivity meter
3.	Organic Carbon	1.74%	Walkley-Black method Titration and colorimetric method
4.	Nitrogen	0.0644mg/gm	Khjeldhal method
5.	Potassium	0.12mg/l	Flame Photometric
7.	Phosphorus	2.33kg/ha	Olsons Colorimetric method
8.	TPC(Microbiological Count)	41 x 10^{-4} cfu/ml	Spread Plate Method

Comments:

- Soil is slightly alkaline
- Conductivity is within permissible limit.
- Organic Carbon is High
- Potassium is found to be very less in the soil sample.
- Nitrogen is very less in the soil sample.
- Phosphorus is found to be less in the soil sample.
- Microbiological count was done the soil area of Taloja shown 41x10^{-4} cfu/ml further studies like isolation of microorganisms can be done in order to make the study worthier and informative.

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April 09, 2023

WATER ANALYSIS REPORT

Sample 01 (Area:Taloja Lake)

Sr.No.	Parameters	Sample Reading	BIS Standard
1.	pH	7.64	6.5-8.5
2.	Conductivity	0.456microsiemens/cm	0-200microsiemens/cm
3.	Turbidity	18.5NTU	10NTU
4.	Total Hardness	104mg/l	---
5.	Chloride	51.69mg/l	---
6.	BOD	1.89mg/l	3mg/l
7.	COD	104mg/l	---

Comments:

- pH is slightly alkaline; but found to be within the permissible limit.
- There are no prescribed standards for Hardness, Chloride and COD.
- There is no standard prescribed for the COD parameter but then if the COD value is greater than 250mg/l it will indicate that there is an industrial discharge to the lake sewers. As the COD value is 104mg/l it indicates that there is no discharge of any industrial effluents to the water body.
- Conductivity, Turbidity, and BOD parameters are within the permissible limit and the water is found to be potable for further usages.

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Annexure 14: Video Script

Topics	Narration	Visuals
Title	iNaturewatch Foundation presents Reforestation of Taloja Hill Watershed through Community Participation This short film chronicles the process of reforestation of Taloja Hill Watershed through Community Participation in Kharghar as part of DCB Bank's CSR initiative.	Taloja hills in background
Introduction	The Taloja Hill Watershed includes the hills surrounding Taloja pond and the Owe dam. It got its name because of its proximity to Taloja Jail. It's a watershed zone since it collects precipitation that eventually flows into Taloja pond. The area is close to Kharghar, Navi Mumbai, Sector 35-G. The Panvel Forest Department owns a section of it. This film chronicles the transformation of a degraded hills into a better ecology.	Drone shot of current & old pictures of hills, Also Use google map
History	In 2016 community members started plantation at the hills on individual level to accomplish slope greening. In 2020, the iNaturewatch Foundation reforested 7.3 ha. of hill by planting more then, 8000 saplings through a CSR project of DCB Bank Ltd. The three-year project ended in 2023. The reforestation project resulted in better conditions for wildlife, vegetation, soil, water, and ecotourism. The hills were battling a number of challenges, including deforestation, mining, soil erosion, forest fires, cattle grazing, and garbage dumping by picnickers. The water in the pond had oxygen deficiency.	Old pictures of the hills, logos of DCB Bank, iNaturewatch Foundation, Forest Department
Project Initiation	Regardless of the lockdown, the project began in April 2020. We established the project office and team. We did the site survey and selected 7.3 ha of land for plantation. A biodiversity survey, soil and water analysis were conducted to determine the soil and health. We identified 40 species of plants, 13 species of insects, 1 species of reptiles, and 34 species of birds. The soil and water were of poor quality.	Old pictures and video clips of baren degraded site. Survey pic of Dr Shubhalaxmi and Isaac Kehimkar
Ground Preparation	As a result, we began the process of preparing the site for the plantation. Our goal was to plant 5000 saplings of various types of plants, including herbs, shrubs, and trees. Along the leeward side of the hills. We prepared the ground by digging trenches and pits. We supplemented the soil with compost and cow dunk.	Pictures and videos of ground preparation. And leeward and windward side of hills.
Plantation	After preparing the ground, we planted 321 trees, 850 shrubs, and 250 herbs in July 2020. A total of 921 saplings were planted, representing 17 distinct species. The target was to plant 2500 saplings however due to the COVID lockdown we managed to plant only 1421 saplings. During the second phase i.e. April 2021-March 22 we planted 6969 saplings including 1727 trees, 1085 shrubs, and 4157 herbs. A total of 6969 saplings were planted, representing 40 distinct species.	Pictures and shots of plants and plantation. Comparison shot the saplings planted in 2020, 2021 & 2022 same in 2023

	In Jul-Sep 2022 we planted a total 1414 saplings as compensatory plantation for replacing the dead saplings. We planted 523 trees, 691 shrubs, and 200 herbs. A total of 1414 saplings were planted, representing 30 distinct species. This started transforming the hill's appearance. Today 2873 saplings including herbs, shrubs and trees are surviving at the site fighting against all odds like forest fires, cattle grazing, poor soil, harsh weather, vandalism and so on.	
Contour bunding	Contour bunds were developed on the hill slopes to capture and hold rainfall before it can become runoff. Contour bunding is a proven sustainable land management practice for marginal, sloping, and hilly land. This technique helps to capture and hold rainfall before it can become runoff and helps in increasing water filtration to reduce soil erosion and nutrient loss.	Pictures or shots of contour bunds
Nature trail development	Three nature trail pathways were identified and mapped with GPS on Google Earth. Interventions were done like levelling wherever required, making steps on steep slopes. We also demarcated the pathway by fixing tender water coconut shells on the pathway edges. However later the plan was dropped as Forest Department had their own plans of developing the nature trails. Hence the Pocket Field Guide on Taloja Hill Forest was developed and the Naturalist Training Programme was conducted to train 25 nature enthusiast who can lead nature trails for the Forest department.	Pictures of laying of coconut shell for pathway edging.
Irrigation system	Establishing an irrigation system in the hills without using electricity was a tough nut to crack. Water tanks were installed at strategic locations to make use of the gravitational force for watering. Water pump running on petrol was used to fill the tanks with water from the perennial well at the site. Pipes and buckets were used for watering saplings high up on the hills.	Pictures and videos of watering
Maintenance Activities	A variety of maintenance activities were carried out by the caretakers and volunteers to take care of the saplings. • De-weeding Ring de-weeding • Mulching • Grass cutting • Grass pressing • Tree guard installations	Photographs or video clips of each activity
Forest Nursery	A forest nursery was developed with the help of volunteers who collected the seeds of wild plants from the surrounding forest area along with the caretakers. These seeds were sowed in the sapling bags which were made by the volunteers and raised for a year and then planted on the hills during monsoon. Volunteers also collected milk bags to grow saplings. A way to reuse the milk bags.	Photographs or video clips of Forest nursery. Seed bag making and Saplings.
Biodiversity Survey	The vegetation has started providing food and shelter to number of animals especially pollinator and attracting biodiversity, despite the fact that only 88 species of flora and	Pictures of wildlife plus interviewing Dr Shubhalaxmi in

	fauna were recorded at the project's inception. The count has now increased to 395 species. The total plant species has increased from 40 to 172, insect species has increased from 13 to 89 and arthropod species has increased from 0 to 11, amphibian species has increased from 0 to 7 species, reptile species has increased from 1 to 17 species, bird species has increased from 34 to 78 and mammal species has increased from 0 to 10. All life forms, such as insects, birds, reptiles and amphibians, are equally diverse. A chameleon was observed at the location. The reason for increase can be systematic surveys as well as improvement in habitat.	importance of biodiversity and increase of species number at site. Photographs of highlight species.
	Biodiversity Survey Highlights **Drosera indica (*Indian Sundew*):** An uncommon insect eating plants growing on the rocky, wet slopes and wet mud on the hills during monsoon. They capture the insects with the help of the sticky liquid drop at the tips of the tentacles. The tentacles drown the prey in a digesting enzyme-laced liquid. The carnivorous diets helps them to survive in the poor soil. **Hairy Okra (*Abelmoschus Manihot*):** The nearest specie of the edible Ladyfinger. While the large yellow flowers are very ornamental, the importance of this plant is that it is one of the world's most nutritious leafy vegetables because of its high protein content. The leaves are tender and sweet and can be served raw or steamed **Frilly Lepidagathis (*Lepidagathis trinervis*)**: Found only in India and Pakistan this ground hugging plant grows on rocky surfaces. **Red Helen Butterfly (*Papilio Helenus*):** It was recorded for the first time in the Navi Mumbai area.	
Base line survey and Socio Economic Survey	We conducted a baseline survey at the site and comprised of various parameters of the project site such as its Geographic coordinates, area size, land use, biodiversity, and threats. We conducted a Socio Economic Survey in the Ove village to learn more about the key elements in the firewood consumption and other non-timber product habits of the people who live near our Taloja hills. It was observed that around 73% are using forest wood on daily basis. And 12.5% collect wood on daily basis. 76% use chulha at home inspite of having gas. Up to 53.1% are aware of the iNaturewatch Foundation's plantation and 73% are eager to work with us on this project. Our goal was to determine the proportion of local communities that are still completely reliant on the forest.	Photographs of survey
Community	We began recruiting local residents as hill volunteers and made	Community

engagement	a "Kharghar Hills" whats app group for them to engage them in the activities. They took part in clean-up drives, tree plantings, deweeding, installing tree guards, sapling bag making and seed ball making. The community members using the hills for morning and evening walks began to notice the restoration work and started volunteering. We also conducted awareness programmes like moth watching and nature trail for school and college students.	engagement activities pictures and shots plus some interview of community members
Naturalist training programme	Twenty-five nature lovers from Navi Mumbai and Mumbai area were trained to conduct nature awareness programmes at the hills. It was a 4 weekend programme including field activities at the site in morning and evening online lectures by experts. The programme ended on 3 march 2023 with a validatory function wherein the Mr. Sanjay Waghmode from Forest Department felicitated the participants with certificates and nature field kits.	Photographs and feed back video of participants.
Field Guide	A 18-page pocket field guide brochure was developed which capture the biodiversity highlights recorded from the project site. It includes 49 species of plants and animals observed at the site. A pocket field guide to Taloja Hill Forest was released by eminent wildlife conservationist Mr Bittu Sahgal, Founder-Sanctuary Nature Foundation on 24th March 2023 and Hornbill House, BNHS. The event was covered in eight news articles and highly appreciated by the print media along which the efforts taken for the reforestation of the Taloja Hills. The field guides are given to the participants who attend the volunteering and nature awareness programmes at site.	Photographs of the field Guide
Conclusion	We are pleased that our project is in time when the United Nations has declared the Decade of Ecosystem Restoration (2021–2030). It aims to avert, halt, and reverse ecosystem degradation on every continent and ocean. It has the potential to assist in eradicating poverty, combating climate change, and averting mass extinctions. It will succeed only if everyone contributes. We contributed in our own way. It is now up to the local community members to look after this plantation and keep it safe and healthy. However this is not the end we are looking an extension of the project as Forest Department has already agreed to extend it for another 5years.	Interview of iNaturewatch team members, community members and DCB Bank
Titles	Acknowledgments We are thankful to DCB Bank Ltd for supporting this project. Forest Department for partnering with us. Community members for providing local support especially Ms. Jyoti Nadkarni and Mr Nitin. Ladybird Environmental Consulting for providing technical support. Script: Dr. V. Shubhalaxmi & Ms. Priti Choghale Narration: Stills & Video footage:	

Annexure 15: Plantation Review

Sr. No.	Type	Name of Plants	Planted	Review (Mar 2022)	Review (June 2022)	CP in July-Sept22	Review (Sep 2022)	Regeneration	Review (Dec 2022)	Review (Jan-Mar 2023)
1	Herb	Agave	200	103	21		20		61	39
2	Herb	Bamboo	200	76	78		122		153	118
3	Herb	Euphorbia	3632	500	0		14		7	10
4	Herb	Gulvel	25	15	0	150	70		29	0
5	Herb	Khus	150	119	81	50	136		181	134
6	Herb	Spiral Ginger	100	65	18		0		0	0
7	Herb	Water lily	5	2	0		0		0	0
8	Herb	Wild Aboli	50	29	0		0		0	0
9	Herb	Wild banana	150	32	36		17		6	8
10	Shrub	Bitter Hedge	250	156	6		45		44	35
11	Shrub	Christ's thorn (Karvanda)	550	805	588	396	396		478	505
12	Shrub	Crested Barleria (Kate Koranti)	150	140	63		29		29	15
13	Shrub	Crotalaria	3	2	0		0		0	0
14	Shrub	Fever Nut	0			181	181		217	197
15	Shrub	Flame Bush	200	174	79		73		61	65
16	Shrub	Giant Milkweed	10	9	0		1		3	2
17	Shrub	Green milkweed climber	50	23	2	19	21		12	10
18	Shrub	Hiptage	25	12	0	15	15		19	20
19	Shrub	Ixora	25	21	1		4		1	1
21	Shrub	Karvi	50	4	0		30		12	12
23	Shrub	Touch me not	0			80	114	34	61	31
24	Shrub	Wild Jasmine	25	22	28		4		13	10
25	Tree	Acacia	50	50	102		85		82	90
26	Tree	Ain	0			33	3		0	25
27	Tree	Asan	100	83	57	15	72		78	75
28	Tree	Bael	30	19	22		9		16	10
29	Tree	Barringtonia acutangula/ Nevari	0			20	8		15	10
30	Tree	Behda	10	3	3	30	22		11	15
31	Tree	Ber	100	77	68		64		50	52
32	Tree	Cluster Fig	20	19	2	18	20		21	18
33	Tree	Flame of Forest	69	47	0	43	49		44	40
36	Tree	Guava	0			2	2		2	2
37	Tree	Hairy Ficus	100	79	126		76		75	72
38	Tree	Indian Butter Tree	10	8	0	60	22		12	6
39	Tree	Indian Chaste Tree	5	5	18		2		5	3

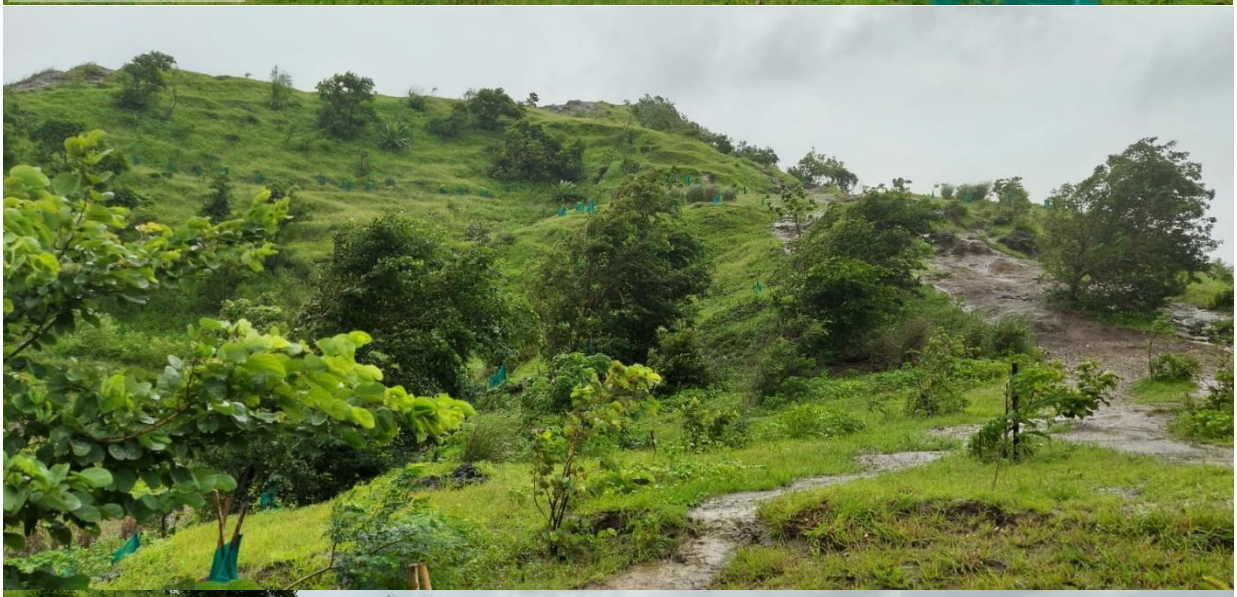
40	Tree	Indian cherry/Bhokar	46	39	16		24		31	30
41	Tree	Indian Coral Tree	302	258	101		104		121	123
44	Tree	Indian Elm	60	55	34	20	55		56	40
45	Tree	Indian Laburnum	76	19	34	19	24		33	9
46	Tree	Jamun	130	123	67	27	72		101	97
48	Tree	Kalamb	60	49	41	15	41		53	40
50	Tree	Macaranga	50	46	25		21		27	28
51	Tree	Mango	0			2	2		8	11
52	Tree	Moi/ Lannea coromandelica	0			20	8		0	10
53	Tree	Neem	20	21	32	14	46		29	44
54	Tree	Pala Indigo	100	91	57		73		47	22
55	Tree	Papaya	0			9	9		5	3
56	Tree	Phanshi	100	100	80		78		93	54
57	Tree	Pongam	177	168	255		316		263	260
59	Tree	Putranjiva	0			11	11		11	11
60	Tree	Queens Flower	25	16	4		18		19	12
61	Tree	Ratan gunj	100	65	31		22		37	33
62	Tree	Red Silk Cotton Tree	192	165	105	10	103		84	67
64	Tree	Scholar's Tree	26	22	23		26		27	25
65	Tree	Sheesham	30	25	14	50	22		24	28
66	Tree	Shivan	10	10	11	5	15		15	12
67	Tree	Slow match tree /Kumbhi	50	50	15	40	32		33	22
68	Tree	Tetu	0			10	10		0	1
69	Tree	Jungli Badam		29			29		29	29
70	Tree	Planted by community volunteers				50	0		0	0
71	Tree	Unidentified plants (only stick were there)							109	232
	Total		**7902**	**4021**	**2344**	**1414**	**2887**	**34**	**3053**	**2873**

Survival rate 52.8% compared to March 2022, Mortality rate 47.2% compared to March 2022
CP- Compensatory plantation

Notes:

- As most of the tree species are deciduous and have shaded leaves the surviving trees appeared as twigs or sticks therefore difficult to identify during the plantation review. Hence, we have included its number separately in the list as Unidentified trees.
- Some plants that were not observed during the monsoons due to the high weed and wild grass growth were visible during this survey as the de-weeding was done.

Annexure 16: Plantation Photographs
August 2022



September 2022

December 2022

March 2023

Drone Shooting

Before (June 2021) – Forest Nursery

After (September 2022)

Before (June 2021) - 2nd Hill

After (September 2022)

Before (June 2021) - 2nd Hill

After September 2022

Before (June 2021) - 1st hill

After (September 2022)

Before (June 2021) - 1st Hill Back side

After (September 2022)

Before June 2021

After September 2022

Annexure 17: Carbon Sequestration

Sr. No	Date	Name	Girth in cms	Carbon stored in kg
1	01-12-22	Indian coral tree	10.16	1
2	01-12-22	Indian coral tree	10.6	1
3	01-12-22	Indian coral tree	19.81	5
4	01-12-22	Indian coral tree	19.3	5
5	01-12-22	Dalbergia	10.6	2
6	01-12-22	Dalbergia	25.4	16
7	01-12-22	Dalbergia	30.48	24
8	01-12-22	Dalbergia	15.24	5
9	01-12-22	Dalbergia	13.97	4
10	01-12-22	Dalbergia	11.68	3
11	01-12-22	Dalbergia	13.2	4
12	01-12-22	Dalbergia	15.24	5
13	01-12-22	Dalbergia	10.16	2
14	01-12-22	Dalbergia	11.43	3
15	01-12-22	Dalbergia	12.7	3
16	01-12-22	Dalbergia	23.36	13
17	01-12-22	Karanj	13.97	4
18	01-12-22	Karanj	11.93	3
19	01-12-22	Karanj	16.76	6
20	01-12-22	Karanj	10.16	2
21	01-12-22	Karanj	10.16	2
22	01-12-22	Karanj	15.24	5
23	01-12-22	Karanj	10.16	2
24	01-12-22	Karanj	10.16	2
25	01-12-22	Karanj	12.7	3
26	01-12-22	Bauhinia Variegata	13.97	4
		Total		**129**

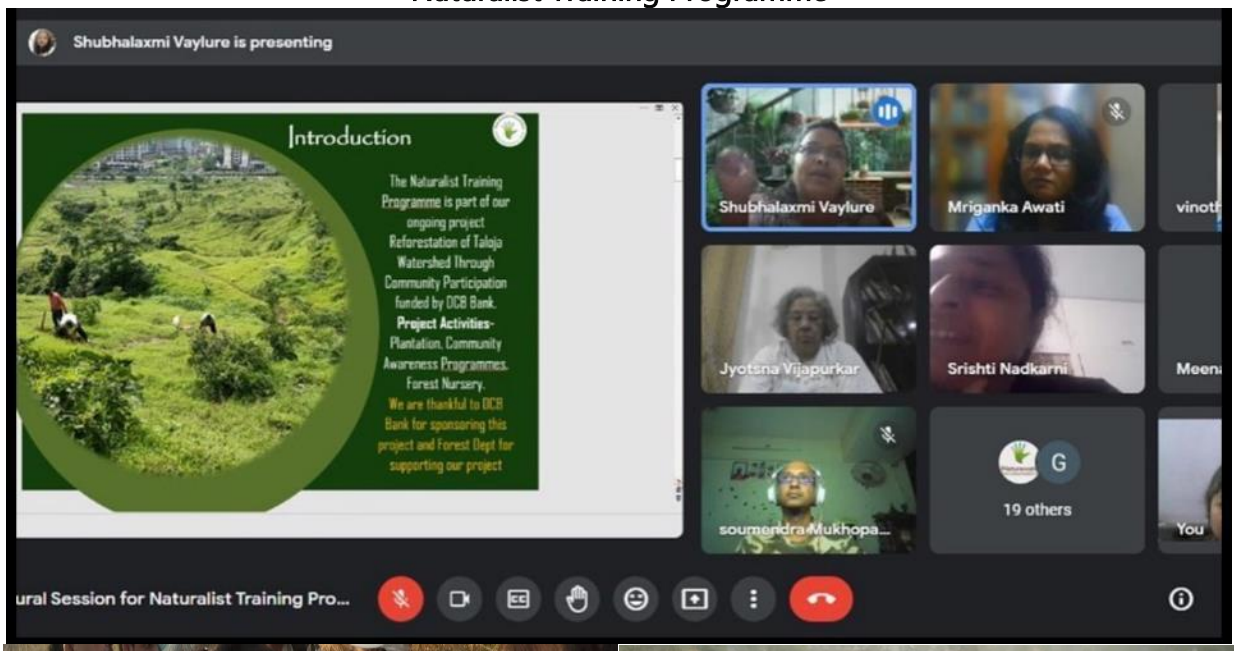
Annexure 18: Community Engagement & Corporate Volunteering Activities

Group Photograph of Volunteers for Clean-up activity

Participants collecting non-biodegradable waste from site

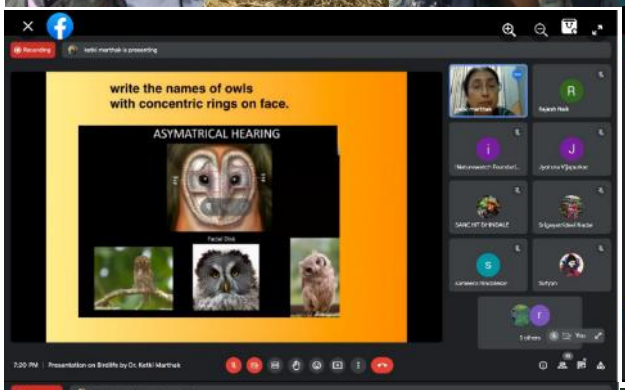
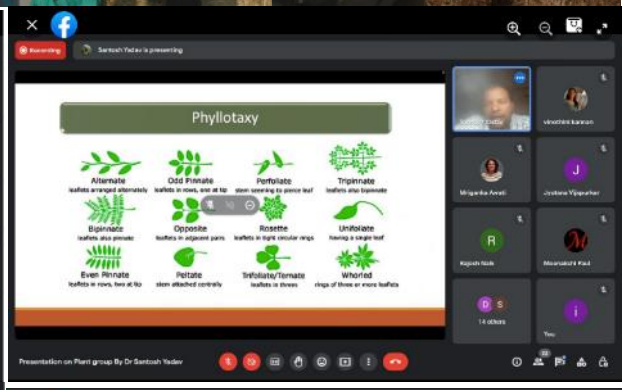
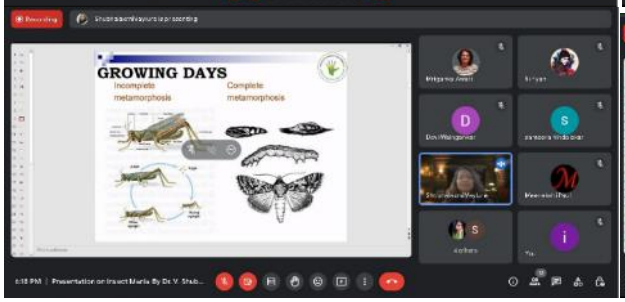
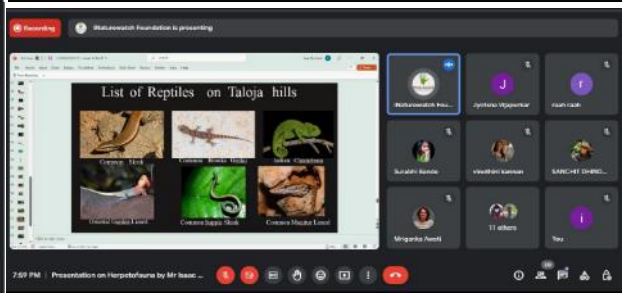
Participants Repairing Tree Guards and collecting seeds

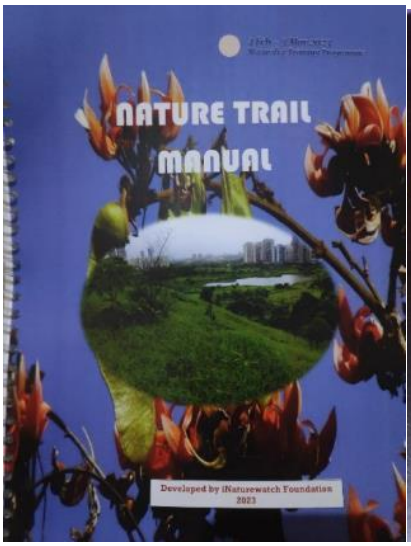
Naturalist Training Programme





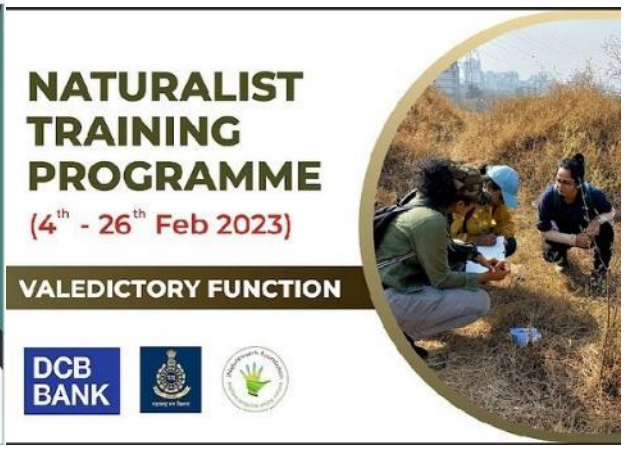




write the names of owls
with concentric rings on face.
ASYMATRICAL HEARING

Phyllotaxy
Alternate
Odd Pinnate
Perfoliate
Tripinnate
Bipinnate
Opposite
Rosette
Unifoliate
Even Pinnate
Peltate
Trifoliate/Ternate
Whorled

GROWING DAYS
Incomplete metamorphosis
Complete metamorphosis

List of Reptiles on Taloja hills


NATURE TRAIL
MANUAL
Developed by iNaturewatch Foundation
2023


cosmus


iNaturewatch Foundation
CERTIFICATE OF ACHIEVEMENT
THIS ACKNOWLEDGES THAT
Mr./Ms. _____
HAS SUCCESSFULLY COMPELETED
Naturalist Training Programme a 4-Weekend hybrid field and online course
Conducted by iNaturewatch Foundation
Date: 3rd February - 26th February 2023
Dr. V. Shubhalaxmi
Course Coordinator
Mr. Isaac Kehimkar
Director
Shop No. 123, Grow More Tower, Plot-5, Sector-2, Opp. Cafe Coffee Day, Station Road, Kharghar, Navi Mumbai- 410210.


NATURALIST
TRAINING
PROGRAMME
(4th - 26th Feb 2023)
VALEDICTORY FUNCTION
DCB
BANK

Valedictory Function Naturalist Training Programme

Field Guide Release Function