

# IMPACT ASSESSMENT OF FOCUSED DEVELOPMENT PROGRAM

UTTARAKHAND





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# CONTENTS

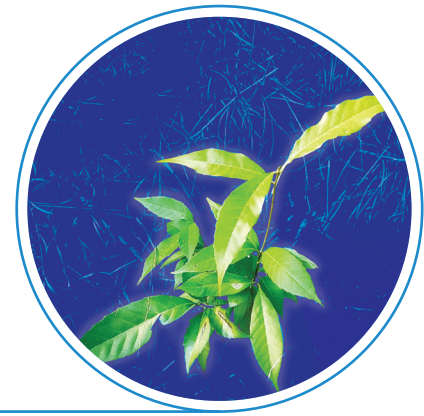
<b>1. Background</b>	<b>6</b>
1.1 International context	6
1.2 National context	7
1.3 About HDFC's Focused Development Program	7
1.3.1 Geographic scope of the program	8
1.3.2 Nainital District	8
1.3.3 Uttarkashi District	9
<b>2. Approach and Methodology of Impact Assessment Study</b>	<b>11</b>
2.1 Objectives and Scope of Assessment	11
2.1.1 Reference period of assessment	11
2.1.2 Geographic coverage of the assessment	11
2.2 Approach to the impact assessment study	11
2.3 Methodology adopted for the assessment	12
2.3.1 Phase 1: Inception	12
2.3.2 Phase 2: Data collection	13
2.3.3 Phase 3: Analysis and dissemination of findings	13
2.4 Quality Assurance	14
2.5 Limitations	14
<b>3. Key Findings</b>	<b>15</b>
3.1 Program relevance	15
3.2 Execution excellence	17
3.2.1 Ramgarh, Nainital	17
3.2.2 Naugaon, Uttarkashi	28
<b>4. Impact</b>	<b>33</b>
4.1 Environmental Impact	33
4.1.1 Forest gap reduction	33
4.1.2 Reclaiming degraded land through soil and water conservation	33
4.1.3 Carbon reduction	34
4.1.4 Disaster risk mitigation	35
4.1.5 Other environmental benefits	36
4.2 Social and economic impact	36
4.2.1 Employment generated	36
4.2.2 Livelihood enhancement	37
4.2.3 Reduced wildlife conflict	37
4.2.4 Tourism	37
4.3. Governance	37
<b>5. Recommendations</b>	<b>39</b>
5.1 Increase Focus on Community Awareness and Sensitization	39
5.2 Establish or Strengthen Community Institutions for Afforestation and Forest Management	39
5.3 Implement Protection Measures for Plantations Through Fencing	39
5.4 Enhance Record Keeping and Documentation Practices	39
5.5 Enhance Donor Visibility	40

## LIST OF TABLES

Table 1: Nainital village sample	12
Table 2: Number of surveys conducted	13
Table 3: Qualitative sample for the study	13
Table 4: Number of respondents per village in Nainital district	18
Table 5: Nathuwakan site profile	19
Table 6: Nathuwakan species count and health assessment	19
Table 7: Baribanj site profile	20
Table 8: Baribanj species count and health assessment	20
Table 9: Bareth site profile	21
Table 10: Bareth species count and health assessment	21
Table 11: Satoli site profile	22
Table 12: Satoli species count and health assessment	22
Table 13: Kilour site profile	23
Table 14: Kilour species count and health assessment	23
Table 15: Number of khaals constructed in each village	25
Table 16: Stakeholder involvement in the plantation	27
Table 17: Lodan site profile	30
Table 18: Lodan species count and health assessment	30
Table 19: Sunara site profile	30
Table 20: Sunara species count and health assessment	31
Table 21: Carbon sequestration potential per plantation in Nainital district	35
Table 22: Carbon sequestration potential per plantation in Uttarkashi district	35
Table 23: Average income per selected villages in Nainital district	37

## LIST OF TABLES

Figure 1: SDGs 1, 11, 13 and 15	6
Figure 2: Map of Uttarakhand	8
Figure 3: Nainital, Uttarakhand	8
Figure 4: Map of Uttarkashi district	9
Figure 5: Assessment framework	11
Figure 6: Age Profile of Respondents	18
Figure 7: Occupation profile of respondents	18
Figure 8: Satellite image of Nathuwakan site in Feb 2019 (Left) and Feb 2024 (right)	19
Figure 9: Satellite images of Baribanj site area in Feb 2019 (left) and Feb 2024 (right)	20
Figure 10: satellite image of plantation site in Bareth in feb 2019 (left) and feb (2024 (right)	21
Figure 11: Satellite image of plantation site in Satoli in Feb 2019 (left) and Feb 2024 (right)	22
Figure 12: Satellite images of plantation in Kilour in Jan 2019 (left) and feb 2024 (right)	23
Figure 13: Livelihood benefits to beneficiaries	24
Figure 14: Survival rate of tree species planted	24
Figure 15: Vulnerability to natural disasters	25
Figure 16: Khal in Baribanj	25
Figure 17: Age Profile of Respondents	29
Figure 18: Satellite image of plantation site in Lodan in Feb 2019 (left) and Feb 2024 (right)	29
Figure 19: Satellite image of plantation site in Sunara in Feb 2019 (left) and Feb 2024 (right)	30
Figure 20: Survival rate of tree species	31
Figure 21: Survival rate of tree species	34
Figure 22: Improvement in Soil Fertility	34
Figure 23: Reduced effects of natural disasters	36
Figure 24: Distribution of Environmental Benefits in the Settlement	36



# Background

## 1.1 International context

Climate change presents a fundamental threat to humans. It affects the physical environment as well as all aspects of both natural and human systems – including social and economic. Rapid urbanization, growing dependence on fossil fuels, and deforestation has led to an increase in global temperatures, extreme climate, and the disturbance of forest flora and fauna. These have pronounced effects on the livelihoods of many people whose income depends on environmental conditions, such as soil and water availability for agriculture and animal husbandry. Increasing atmospheric carbon dioxide and other GHGs (Greenhouse Gasses) have further exacerbated these climate conditions, such as more frequent droughts, flooding, and extreme weather, harming agriculture and allied activities ultimately reducing revenue for communities. In 2017, approximately 22 million people around the world were forced to leave their homes because of the sudden onset of weather events such as flooding, forest fires, droughts, and intensified storms.<sup>1</sup> Aghazarm and colleagues reported that between 25 million to one billion people could be displaced by climate change over the next 40 years<sup>2</sup>.

To mitigate and combat the adversities presented by climate change, the United Nations Framework Convention on Climate Change (UNFCCC) was introduced in the early '90s, followed by the Kyoto Protocol in 1997, and later the Paris Agreement in 2015. The Paris Agreement aimed to limit the global temperature increase to 2°C by the end of the century while pursuing efforts to cap it at 1.5 °C. In furtherance of promoting sustainable development worldwide, the United Nations General Assembly also adopted **Agenda 2030** for Sustainable Development, which includes 17 Sustainable Development Goals (SDGs). These goals outline targets and provide a pathway to guide sustainable social, economic, and environmental development worldwide. Given the looming threat of deforestation, livelihood insecurity, and environmental degradation, SDG-Goal 1: No poverty, SDG-Goal 13: Climate Action, SGD 11: Sustainable cities and Communities and SDG-Goal 15: Life on Land provide targets aim to guide nations towards sustainable practices and ensure healthy ecosystems and economies. These goals reflect a global commitment to addressing key challenges and building a more sustainable and equitable future.

**FIGURE 1: SDGs 1, 11, 13 AND 15**



<sup>1</sup> Goshua, A., Gomez, J., Erny, B., Burke, M., Luby, S., Sokolow, S., ... & Nadeau, K. (2021). Addressing climate change and its effects on human health: A call to action for medical schools. *Academic Medicine*, 96(3), 324-328.

<sup>2</sup> Laczko, F., & Aghazarm, C. (2009). *Migration environment and climate change*.

## 1.2 National context

The effects of climate change in India have been severe, both environmentally and socioeconomically. In 2019, India was the 7th most affected country due to climate change-driven extreme weather events. Further, India's average temperature has risen by around 0.7°C between 1901–2018. This rise in temperature is largely caused by GHG induced warming, intensifying climate change.<sup>3</sup> In fact, extreme weather events due to climate change have left 17 out of 20 people in India vulnerable to extreme hydrological and meteorological (or “hydromet”) disasters like floods, droughts, and cyclones. Approximately 58% of the country's population is dependent on agriculture for livelihood and sustenance heavily reliant on seasonal monsoons. Owing to climate change, the reliability of rainfall has become increasingly precarious due to the unpredictability and variability brought about by climate change. Shifts in precipitation patterns, along with more frequent droughts and floods, can devastate crops, resulting in reduced yields and income loss for farmers. Climate-induced extreme weather events such as floods, droughts, and cyclones often lead to the displacement and migration of communities, uprooting them from their homes and traditional lands. These events exacerbate health risks, with increased incidences of waterborne diseases, respiratory ailments due to air pollution, and heat-related illnesses. Climate change also poses significant challenges to India's social and cultural fabric, impacting traditional knowledge, cultural heritage, and social cohesion. Indigenous communities and traditional societies, deeply connected to local ecosystems and weather patterns, face the erosion of invaluable traditional practices due to climate change, undermining their cultural heritage and resilience. For a country like India, the effects of climate change on the economy are extensive. As populations confront excessive heat and humidity, productivity decreases. The Reserve Bank of India has predicted that the effects of climate change could threaten 4.5% of India's GDP by 2030.

As part of the Paris Agreement, the Government of India approved the updated Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) on August 3<sup>rd</sup>. This revised contribution supports India's goal of achieving net-zero emissions by 2070. The National Mission for Green India is one of the eight missions in the NAPCC and was launched in February 2014 with the objective of safeguarding

the biological resources of our nation and associated livelihoods against the peril of adverse climate change, as well as recognizing the vital impact of forestry on ecological sustainability, biodiversity conservation, and food, water, and livelihood security. Across 15 states, 117,503 hectares of plantation have been completed from 2014-15 to 2020-21. In Uttarakhand, around 7,483 hectares of plantation have been created between 2015 and 2021. The Government of India also established the National Water Mission, which was launched in 2011 under the NAPCC. The main objective of NWM is the “conservation of water, minimizing wastage, and ensuring its more equitable distribution both across and within States through integrated water resources development and management.

## 1.3 About HDFC's Focused Development Program

Towards the national goals for climate action, HDFC Bank has been a key contributor and has played a significant role in supporting the NAPCC program of environmental conservation and sustainable development through its CSR initiatives. Under the **Focused Development Program (FDP)**, HDFC Bank aimed to plant 1 million trees across the country. The program aims to eventually sequester 20 million kg of carbon dioxide per year, and create employment for forest-fringe communities engaged with the project. The primary focus of project was to reclaim degraded lands as primary forests, strengthen forest-based livelihood opportunities for local communities, protect the habitat of endangered species, uplift rural communities, combat air pollution, and rejuvenate water bodies and rural landscapes. HDFC Bank initiated these efforts in 2022. The project aimed at planting 200,000 trees in two districts of Uttarakhand i.e., 150,000 in Nainital and 50,000 in Uttarkashi with Grow Trees as the implementing partner. Grow trees also commissioned a local planting partner in each of these districts. Chirag foundation was engaged to implement and oversee plantation activities in Nainital while Pandit Deen Dayal Upadhyay Centre for Action and Research was engaged for plantations in Uttarkashi.

Accordingly, the primary objectives of this project were:

### 1. Carbon sequestration

- Absorb carbon dioxide to boost environmental conditions.

### 2. Conservation of resources:

- Safeguard biodiversity and habitat in the region.

<sup>3</sup> Carrington, Damian. “A third of Himalayan ice cap doomed, finds report.” *The Guardian* 14 (2019).

- Strengthen forest-based livelihoods and energy sources for local communities, establishing sustainable development.
- Enhance soil fertility and prevent erosion.

### 3. Employment:

- Generate employment for rural communities through their active participation in the plantation process.
- Improve the socio-economic status of rural communities by offering different resources and employment opportunities through the cultivation of Non – Timber Forest Produce (NTFPs) used for weaving, basketry, rope-making, and other handicrafts.

### 4. Natural Calamities and Wildlife Risk Mitigation:

- Address crop raiding by wild animals through the creation of improved wildlife habitats.
- Contribute to the mitigation of future natural disasters.

#### 1.3.1 Geographic scope of the program

The activities mentioned above were implemented in 2 districts of Uttarakhand i.e., Nainital and Uttarkashi. Uttarakhand, a state nestled in the Indian Himalayan Region (IHR) is among those most vulnerable to climate-mediated

risks. Rates of warming in the Himalayas are greater than the global average and the impacts of climate change are anticipated earlier in this region than in other parts of India. These impacts include a decline in snowfall and extent, more intense rainfall, landslides, floods, and droughts.<sup>4</sup> A report published in 2019 predicted that by 2100, at least one-third of the glaciers in the region would have vanished<sup>5</sup> due to climate change. Glacial melting has also exacerbated both flooding and drought, especially in mountain communities that participate in agropastoralism<sup>6</sup> as their main means of economic activity. Extreme weather events, including heatwaves, flooding, and droughts, have had numerous negative effects such as reduced groundwater, reduced soil fertility and increased threats presented by landslides due to surface runoff. They not only constitute a risk to human life but also a pressing economic burden. Livelihoods of most in the state rely directly or indirectly on natural resources either for agropastoral or tourism. Nearly three-fourths of the state's population live in rural areas and depends on agriculture.

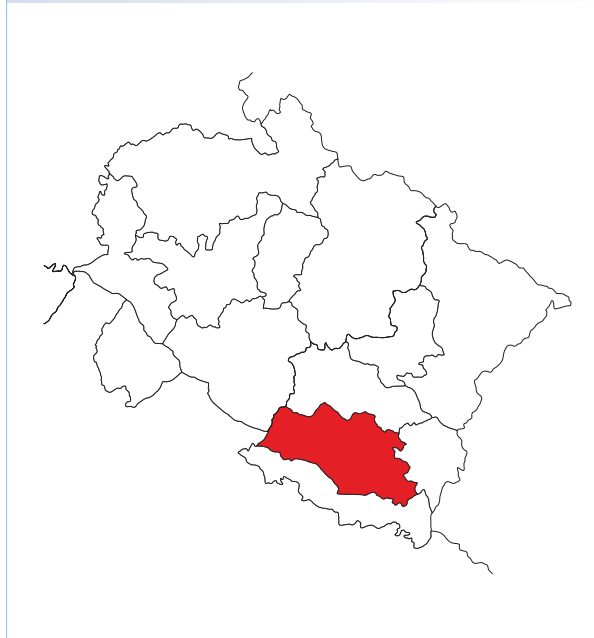
#### 1.3.2 Nainital District

The Nainital district of Uttarakhand state lies within the Kumaon division. It is bordered to the north by the Almora district, and to the south lies the Udham Singh Nagar district. The district

**FIGURE 2: MAP OF UTTARAKHAND**



**FIGURE 3: NAINITAL, UTTARAKHAND**



<sup>4</sup> <https://www.adb.org/sites/default/files/linked-documents/38272-044-sd-03.pdf>

<sup>5</sup> <https://royalpatiala.in/impact-of-climatic-change-and-global-warming-by-2100-at-least-one-third-of-the-glaciers-in-the-region-will-be-gone-hanief/>

<sup>6</sup> Agropastoralism is a farming method that merges crop cultivation with livestock raising, maximizing land use and rural livelihoods.

is home to 954,605 people and covers an area of 4251 km<sup>2</sup> and is located at an altitude of 2,084 metres (6,837 ft) above sea level. In 2021, the overall forest coverage accounted for 71.62% of the total geographical area, with Nainital district situated to the east and Pauri Garhwal district to the west (Districts of India – Socio-economic Statistical Data of Nainital District, Uttarakhand). The soils of Nainital district are mostly categorized as medium to highly fertile. Major soil types in Nainital district include sandy loam, alluvial sandy loam, brown forest soil, and red and black clay soil compositions. The major field crops such as rice, wheat, maize, soybean, ragi, ginger, lentil, pea, and horticulture crops such as mango, apple orchards, and litchi are cultivated in Nainital district. Ramgarh is a small mountain station known as the Fruit Bowl of Kumaon, located at an altitude of 1789 meters above sea level. The area is abundant in a diverse range of exotic fruits, including peaches, apples, plums, pears, strawberries, and apricots, and is mostly covered by forests of pine trees.

The region is mountainous, with dense forests covering the hills. However, in recent years, the ecosystem of Nainital has been under strain. The rapid growth of urbanization, deforestation, tourism, and climate change are the main factors straining the ecosystem of Nainital. Climate change amplifies existing pressures on the ecosystem. Erratic weather patterns, altered precipitation regimes, and rising temperatures affect ecosystem functions and species distributions. The city, nestled around its lake, enjoys slightly cooler weather compared to surrounding areas. Yet, the local population's growth, the rapid influx of tourists, and the concurrent construction of numerous hotels in the catchment area have profoundly affected the region's resources and biodiversity. The lake's water level and biodiversity are declining, while the average temperature is rising. The Himalayan region, including Nainital, is witnessing rapid glacial retreat due to escalating temperatures, further exacerbating water availability changes and impacting local ecosystems, agriculture, and water resources.

Due to its geographical location, Nainital has faced various natural disasters, including landslides, flash floods, glacial lake outburst floods, earthquakes, and forest fires. The recurrence of these calamities significantly affects the district's economy, ecology, and infrastructure. In 2021, Nainital was cut off from the rest of Uttarakhand after heavy rain led to a series of landslides on Tuesday. About 35 people have lost their lives in rain-related incidents<sup>7</sup>.

<sup>7</sup> [indiatoday.in/india/story/uttarakhand-nainital-rain-weather-news-flooding-pictures-videos-1866722-2021-10-19](https://indiatoday.in/india/story/uttarakhand-nainital-rain-weather-news-flooding-pictures-videos-1866722-2021-10-19)

### 1.3.3 Uttarkashi District

Uttarkashi District is a part of the Garhwal division of Uttarakhand state, located in the northwest. It covers an area of 8016 sq. km in the rugged Himalayan terrain. Its diverse geography ranges from snow-deficient valleys to snow-capped peaks and glaciers. The landscape features a series of ridges and valleys, with forests on upper ridges and sparsely populated settlements on hillsides with terrace cultivation. Uttarkashi district is home to the headwaters of the Bhagirathi River in Gangotri (traditionally considered the headwaters of the Ganges) and the headwaters of the Yamuna River in Yamunotri, both of which are very important and popular pilgrimage sites. According to the 2011 census, the district has a population of 330,086. Naugaon block is located in the Uttarkashi district of Uttarakhand. There are a total of 184 villages in the Naugaon community development block of Uttarkashi. The total population of Naugaon block is 65,668, with a male population of 33,343 and a female population of 32,325. There are 12,310 households in Naugaon block, Uttarkashi district. The culture of Uttarkashi district is a blend of diverse beliefs. The valley is mainly composed of alluvial soil. Major field crops such as paddy, small millets, wheat, and barley, and horticulture crops such as apple, orange, mango, litchi, pear, peach, plum, apricot, and walnut are cultivated in Uttarkashi district.

**FIGURE 4: MAP OF UTTARKASHI DISTRICT**



However, population growth has led to irreversible changes that pose a threat to the life support system. Over-exploitation of forests and excessive excavation of roads, tunnels, dams, etc., have resulted in environmental degradation over the past decade. Springs are either drying up or becoming seasonal, further exacerbating the environmental challenges. Due to its geographical location, Uttarkashi has faced various natural disasters such as an increasing trend in precipitation, landslides, temperature fluctuations, forest fires, and earthquakes, which have become increasingly common. Soil erosion is escalating rapidly in the region.

According to data compiled by the state's disaster management department, at least 5,731 people lost their lives, and over 2,000 suffered injuries during natural disasters, primarily triggered by flash floods and landslides, in Uttarakhand since 2000<sup>8</sup>.

In the light of the accentuated vulnerabilities of these two districts in Uttarakhand, HDFC under FDP supported plantation in these two districts.

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<sup>8</sup> <https://timesofindia.indiatimes.com/city/dehradun/over-5700-perished-in-natural-disasters-in-ukhand-in-last-20-years/articleshow/80900475.cms>.

# Approach and Methodology of Impact Assessment Study



The section dwells upon objectives of assessment, geographical coverage, sampling, technical approach and methodological steps for the study.

## 2.1 Objectives and Scope of Assessment

Upon project completion, HDFC Bank commissioned Thinkthrough Consulting (TTC) to conduct an independent evaluation of the FDP in Uttarakhand. The assessment notably focused on examining the processes, outputs, and outcomes of the project with respect to its environmental and socio-economic impact as well as steps taken to ensure sustainability of the program.

**Accordingly, the objectives and scope of the assessment were to:**

- Understand the project context through a secondary literature review and stakeholder consultation.
- Evaluate the impact of the program on all stakeholder groups involved in the and analyse their perspectives.
- Assess project management arrangements, project outcomes and their impact on project locations.
- Document key findings and inferences to provided recommendation for further inputs in the project with a focus on strengthening project management and implementation processes. Efficiency and sustainability.

### 2.1.1 Reference period of assessment

The assessment of this project was conducted in February 2024.

### 2.1.2 Geographic coverage of the assessment

The project, in its implementation phase, covered a total of 12 locations in Uttarakhand state, which included 10 villages in the Nainital district and 2 villages in the Uttarkashi district. For this assessment, the TTC team undertook physical verification of 7 sites: 5 out of 9 in Nainital and 2 out of 2 in Uttarkashi district. Villages were selected to gain diverse perspectives for planted species, geography (high and low altitude) and economy. The sampling of these locations aims to provide a comprehensive and diverse perspective on the project's effectiveness and impact.

## 2.2 Approach to the impact assessment study

To assess the impacts that have come about on account of FDP, TTC adopted a mixed- method approach. This approach involved both qualitative interactions and quantitative survey at both districts of Uttarakhand. The use of this method was necessary to understand the impact of this program through its relevance, execution excellence, and outcomes.

**FIGURE 5: ASSESSMENT FRAMEWORK**



The relevance section of this report highlights the purpose of this program, i.e., the problem it is attempting to address from the perspectives of various stakeholders and the surrounding ecology. Execution excellence, on the other hand focuses on the extent to which the program objectives were met. Execution excellence of the program will be assessed through a PCS framework, i.e., Plantation development strategies, community engagement and sustainability. Finally, the outcomes section of the report gauges the immediate and long term benefits that the program provided to the various stakeholders involved. Outcomes and impact was studied through an ESG lens, i.e., environmental outcomes, socio-economic outcomes and governance.

The overall assignment was consultative and participatory in nature. Checklists and tools were collaboratively developed in consultation with both the HDFC Bank and Grow Trees teams.

## 2.3 Methodology adopted for the assessment

TTC adopted a phased methodology for this study, phase 1: Inception, phase 2: Data collection and phase 3: Data analysis and dissemination of findings. The detailed work steps in each of these phases are enumerated below.

### 2.3.1 Phase 1: Inception

During this phase, a desk review of documents and relevant literature was conducted to understand the project design, project rationale, and implementation mechanisms in detail. The documents such as the project proposal, annual report, third-party audit reports, stakeholder engagement strategies, planned tree species, and sustainability plans submitted by Grow Trees were analyzed.

Building upon the insights gathered during the desk review, TTC finalised the sampling method, stakeholder mapping, and methodology in collaboration with the HDFC Bank team. Additionally, draft field tools were developed at this point for qualitative interaction with stakeholders.

#### Sampling

##### **Nainital district**

Out of the total 10 intervention villages, five villages were selected as a representative sample in Nainital. This sample hinges on the following parameters.

**Altitude and geographical coverage:** The intervention villages are distributed across the Ramgarh block in Nainital,

exhibiting diverse altitudes, slopes, soil types, and water availability. With these factors in consideration, the sampling process was meticulously designed to capture the nuances arising from these varying conditions.

**Number and species planted saplings:** Depending on village size and land availability, the number of saplings planted varied from village to village. The sample was selected so as to ensure that small, medium and large plantation efforts were covered. The sample also ensured to cover the variety of species planted so as to capture the survival rate and success of various species.

The table below depicts the villages that were selected as part of the sample.

**TABLE 1: NAINITAL VILLAGE SAMPLE**

Village name	Sample selection
Nathuwakan	
Kilor	
Satoli	
Bareth	
Baribanj	
Meora	
Kwarab	
Sainj	
Darima	
Suralgaon	

*Sampled village are highlighted in blue*

#### **Uttarkashi District**

Of the two intervention villages in Uttarkashi, both were selected. These villages were Lodan and Sunara.

#### **Plantation Sample**

In areas where gap filling was done through plantations with uneven spread, TTC employed a sub-sampling of plantation sites using a random stratified sampling method. The TTC team undertook physical verification of about 10% (approximate) of the plantation area. This helped us to capture survival rate of trees effectively.

#### **Quantitative Sample**

Based on the statistical formula, it was determined to conduct a quantitative survey of 220 respondents. Thus, a total of 220 direct beneficiaries were proportionally distributed among the two districts as per the total number of beneficiaries.

### Statistical Formula for Quantitative Sampling

$n = N * X / (X + N - 1)$  where,

$X = Z_{a/2} / 2 * p * (1 - p) / MOE^2$ , and  $Z_{a/2}$

is the critical value of the Normal distribution at  $a/2$ .

At a confidence interval of 95%, z score of 1.96, margin of error of 5%, 5% non-response and finite population correction factor.

**TABLE 2: NUMBER OF SURVEYS CONDUCTED**

Districts	Village	No of surveys proposed	Number of surveys conducted
Nainital	Bareth	30	27
Nainital	Baribanj	30	20
Nainital	Satoli	30	29
Nainital	Kilor	30	28
Nainital	Nathuwakan	40	31
Uttarkashi	Lodan	30	19
Uttarkashi	Sunara	30	0
<b>Total</b>		<b>220</b>	<b>154</b>

#### Qualitative sample

The study team also conducted qualitative interactions with various stakeholders of the project to understand their perspective regarding the project's relevance, execution and impacts. The sample for these interactions is indicated in the table below.

**TABLE 3: QUALITATIVE SAMPLE FOR THE STUDY**

Stakeholder	Type of interaction	Number of interactions conducted
Implementing agency	KII	2 (1 per district)
Government stakeholders (van panchayat members)	KII	2 (1 per district)
Panchayat stakeholders	KII	7 (1 per panchayat)
Direct beneficiaries	FGD	7 (1 per site)
Secondary beneficiaries (family members of direct beneficiaries and community members)	FGD	7 (1 per site)

### 2.3.2 Phase 2: Data collection

Phase 2 involved the collection and collation of data. Both qualitative and quantitative methods were employed for data collection. Quantitative data was collected to understand the health and status of plantations, employment generation and beneficiary inclusivity. The qualitative information focused on community perception and relevance of the project, community involvement in project planning and environmental impact. Qualitative data collection utilized FGDs and KIIs as tools. These tools contained highly in-depth, semi-structured questions. Good practices and case studies were also captured through this study.

#### Physical verification of plantations

Where tree plantations were evenly distributed on hills across areas with slopes, the TTC team employed the quadrat method. Quadrats are square areas whose sizes can vary. Quadrats, which are square or rectangular frames, were placed randomly or systematically in the area, and the number of organisms or plants inside each quadrat was recorded. This process was repeated for enough times to obtain a representative sample, and the data collected was analysed to calculate density and distribution.

#### Quadrat Method

For physical verification of plantations, the study team initially carried out a transect walk of the plantation area(s) to identify patterns in plantation, mortality or other factors. Following this, an area was demarcated that would be representative of remaining plantation area. The team then physically counted plants, ascertained their species, survival, health and spacing.

### 2.3.3 Phase 3: Analysis and dissemination of findings

This phase included collating the information gathered during the field visit. It entailed an intensive review and analysis of the primary and secondary data both of which were cross-validated and assessed for veracity, consistency, and completeness. The data generated were analysed to assess the achievements and impact of the project on the beneficiaries. The present report has been prepared based on these findings.

## 2.4 Quality Assurance

The following measures were taken to ensure the quality of the assessment:

- **Thorough Training:** Data collection teams underwent rigorous training to ensure a comprehensive understanding of the study objectives, methodology, and tools. A one-day training session was conducted, supplemented by mock practice sessions to familiarize the team with the tools employed.
- **Effective Team Leadership:** The TTC team conducting the data collection was led by an experienced team leader competent in both qualitative and quantitative data collection. Daily debrief sessions were conducted in the field, led by core team members, to address any challenges and inconsistencies in the administration of tools and data collection.
- **Engage Stakeholders:** Key stakeholders, including local communities, government authorities, project beneficiaries, and environmental experts, were actively involved as their insights and viewpoints are necessary for a comprehensive assessment.
- **Review of Data:** The data collection involved a perception survey, providing real-time access to the core team. Qualitative data were evaluated thematically and systematically labelled.
- **Transparency and Accountability:** Maintaining transparency during the assessment process involves sharing methodologies, data sources, and analysis techniques. To ensure accountability, it is essential to document and address any potential biases or conflicts of interest that may arise.

## 2.5 Limitations

- Recall bias is a systemic error in assessments that involve interviews or questionnaires. It is caused by differences in the accuracy or completeness of the recollections retrieved by the respondents regarding activities or events. For the present project, it was observed that respondents demonstrated some recall bias in the case of activities in the program and their timelines.
- The insights presented in this report are based on the data/information provided by the various stakeholders including Grow Trees and local implemented partner. This report, therefore, sets forth views based on the completeness and accuracy of the facts stated or provided in the written material shared with TTC and any assumptions that were included; the accuracy or completeness of these facts, thus, has a material effect on this report.
- To the best of their ability, the team has tried to ensure and validate the authenticity of data/information provided by respondents. However, it is fair to assume certain errors in recording.
- Due to the festival (Basant Panchami) on 14<sup>th</sup>, Feb 2024, and other social functions, a number of respondents were engaged elsewhere during the study period. As such, challenges were encountered on the field with respect to interaction with some beneficiaries and stakeholders of the project. This was especially limiting during the study in Sunara, where almost all community members left the village for a wedding. Due to this reason, surveys could not be conducted in Sunara, however qualitative interactions were conducted telephonically at a later date.
- As the study was conducted during the winters, several plants had shed their leaves, making it challenging to identify the species of plants during physical verifications. To offset this limitation, study team covered a wider area of plantation.



## Key Findings

HDFC Bank's FDP aimed at enhancing the livelihood, quality of life and ecology of communities across nine states and 13 districts in India. This section presents key findings from the program's implementation with emphasis on the overall governance structure, delivery mechanism, and community engagement. The section elaborates upon program relevance and execution excellence (PCS) in detail. Based on the findings from the field and understanding the program nuances, the subsequent sections will unpack each of the section in detail to evaluate the program's impact on ground.

### 3.1 Program relevance

Climate change poses significant challenges to sustainable development, impacting various aspects of society, economy, and the environment. Scientific communities observe a rise in temperatures across the globe and weather patterns

become more erratic, the impacts of climate change intensify, exacerbating existing vulnerabilities and inequalities. These impacts hinder efforts towards achieving sustainable development goals in several ways. Climate change threatens environmental sustainability by altering ecosystems and disrupting ecological balances. It further poses risks to social development by intensifying poverty, inequality, and vulnerability. Climate change also undermines economic development by disrupting ecosystems, disrupting supply chains, and increasing resource scarcity and production costs. To achieve sustainable development, afforestation is one of the significant solutions to overcome climate change issues. Afforestation is the process of planting trees and plays a crucial role in mitigating climate change and promoting environmental sustainability. Firstly, afforestation helps absorb carbon dioxide from the atmosphere through the process of photosynthesis and stores it in their biomass.

### SUSTAINABLE DEVELOPMENT GOALS LINKED TO ENVIRONMENT



Afforestation not only fosters employment opportunities but also enhances livelihoods through the provision of fruits, timber, and other valuable products.

Afforestation plays a key role in advancing sustainable practices for the production and extraction of goods from the ecosystem.



Healthy trees contribute to planetary cooling by absorbing carbon dioxide and increase the resilience of the ecosystem.

Afforestation not only fosters employment opportunities but also enhances livelihoods through the provision of fruits, timber, and other valuable products.



Afforestation also aids in the restoration of biodiversity by providing habitat and food resources for a wide range of plant and animal species. Forest ecosystems provide towering canopy trees, understory shrubs, and ground-dwelling organisms to diverse communities of flora and fauna. Creating a new habitat through plantation can help support native species populations, promote species diversity, and restore the ecosystem. Additionally, afforestation plays a crucial role in the restoration of ecosystems by promoting soil stability, increasing water content in soil, and enhancing soil fertility.

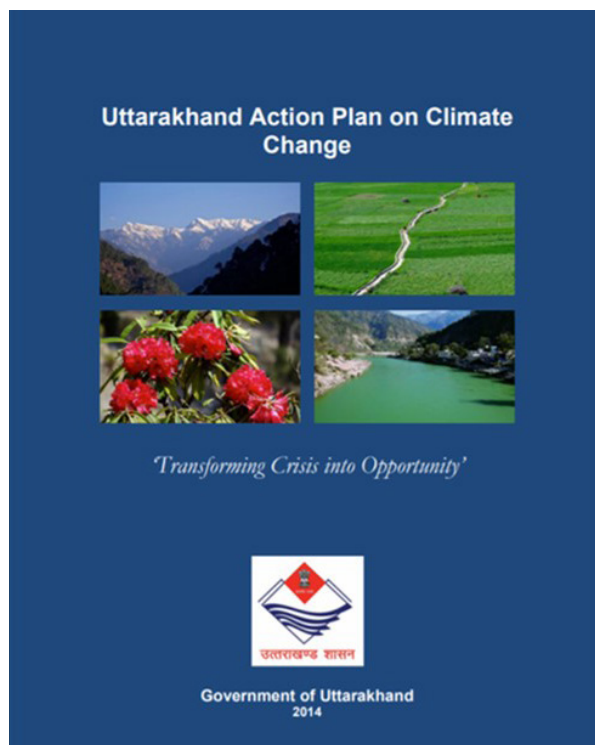
Afforestation is directly linked to the global SDGs as they have unswerving impacts on the environment. It is directly related to SDGs 1, 11, 13, and 15. Other SDGs are related indirectly to the activity such as SDG 17: Partnership for the goals; peaceful collaborations are the key to implementing the process with superior consequences. SDG 3: Good Health and Well-Being; trees have numerous benefits including cleaner air, healthy food, and clean water. The benefits don't stop here, they also have medicinal value. The international focus on sustainable development has been translated at the national level as well. Forests in India are under stress due to the rapid infrastructure development and accompanying urbanization. Efforts at the national level are underway to combat climate change and make resilient communities and ecosystems.

The aims and objectives to arrest climate change through afforestation envisioned at the national level require active cooperation of the states and districts. For their realization on the ground, it is critical that local communities take ownership and action towards these goals. Each state has different climatic conditions in India. Along with that the economic and demographic profile also varies. Thus, mitigating climate change would require localized efforts by states. To this end, states have prepared contextual State Action Plan on Climate change.

These action plans prioritise increasing the green cover in the through various measures including afforestation and reforestation. Thus, FDP directly aligns with the international, national, and state priorities of afforestation. It is in congruence with Uttarakhand State Plan of Action for Climate Change (SPACC). (See figure)

It is important to note that due to historical reasons, Uttarakhand has witnessed invasion of species such as pine. A pine, locally known as 'Chir ka ped', (scientific name:

## UTTARAKHAND SAPCC



### NAINITAL

Encouraging extensive tree plantation to optimize environmental advantages.

Forest fires management

To protect the plantation sites from wildlife conflicts

### UTTARKASHI

Expanding the current expanse of forests and trees while enhancing the quality and density of degraded forest areas.

Planting tree species that help in natural disasters resilience

Enhancing socio-economic status of rural communities by promoting planting of NTFPs (Non- Timber forest produce)

*Pinus roxburghii*), is a conifer that covers about 16% of the forest area in Uttarakhand. It is one of the six pines in India that have maximum occurrence and area. Pine has been in the Himalayas for a long time, but the expansion of Indian Railways and resin-tapping during the colonial times gave it a big push. The number of pine trees plantations started

increasing steadily by clearing the local forest vegetation.<sup>9</sup> The invasion of pine species in forests was reported by respondents during FGDs and IDIs as well.

It is critical to note that FDP factored in this challenge of invasive species by promoting plantation of locally relevant species such as Banj, Silver Oak and Deodhar.

Additionally, plantation drives not only address the community's needs but also stand as one of the most engaging activities, offering environmental, economic, and social advantages in both the immediate and long term. From an environmental point of view, it contributes to clean air, enhances biodiversity, enriches soil, and increases precipitation. Trees play an important role in maintaining the ecosystem by improving soil health, enhancing biodiversity, and rejuvenating degraded land. Additionally, trees provide economic benefits to communities by offering fodder, timber, fruits, and vegetables. Plantation is an inclusive activity that encourages communities to come together and promotes community ownership.

Uttarakhand's diverse topography and climates provide habitats ranging from subtropical forests in the lowlands to alpine meadows and glaciers in the high mountains. Currently, Uttarakhand is facing various challenges such as floods, landslides, and unpredicted rainfall etc., due to the climate changes. Planting locally relevant species help replicate natural ecosystems, enhancing ecological diversity and resilience to environmental stresses. Plantation drives steered as part of FDP in two districts (Nainital and Uttarkashi) of Uttarakhand harnessed these community level benefits as well.

During the qualitative interactions in both districts, all community members agreed and confirmed that the project was relevant to the region and would benefit the community in the long term. During the quantitative survey, out of 141 respondents, 140 reported that the tree species planted are relevant to their local community. During the qualitative interaction, PRI and community members also reported that the tree species are relevant to the local ecology.

In Nainital, the primary objective of the plantation was to raise awareness, restore biodiversity and ecosystems, and create livelihood opportunities. It focused on enhancing the community management system for sustainable development, known as Van Panchayats, and safeguarding the biodiversity habitat of the region. Additionally, it will also

strengthen livelihood options and improve ecosystem of the region.

In Uttarkashi, the emphasis was on expanding plantation efforts to improve the ecosystem and biodiversity of the regions. The efforts also aimed at strengthening the socio-economic status of communities by providing forest-based livelihood options and long-term energy sources for local communities.

## 3.2 Execution excellence

This section of the report focuses on the execution excellence of the program and achievements of the targets set out in its mandate. These findings will be presented for each district, i.e., Ramgarh, Nainital and Barkot, Uttarkashi. Additionally, the findings for the program in Nainital will be divided into two categories of villages.

The primary focus of the program here was to reclaim degraded forest land through afforestation. Additionally, the program also sought to improve the carbon sequestration potential of forests, create employment and foster opportunities for long term livelihood benefit, and promote knowledge and awareness about ecological conservation to educate the rural community members to build a sustainable future. Under the program's mandate for Nainital, it was proposed that 1,50,000 local NFTP trees (Non-Timber Forest Product) would be planted in 10 villages creating important workdays for local community members. Additionally, the program also sought to strengthen forest management through awareness and capacity building of 'van Panchayats'.

The execution excellence of this FDP in Uttarakhand will be analysed and presented through the aforementioned PCS (Plantation development strategies, community engagement and sustainability) framework.

### 3.2.1 Ramgarh, Nainital

For the impact assessment study in Nainital, five out of the total 10 villages were sampled. Parallely, the study team also conducted a physical verification of 5 sites: one in each of village.

#### Respondent Profile

The study team visited and conducted 135 surveys across 5 intervention villages in Nainital. The surveys were conducted primarily with beneficiaries from the five intervention villages of Ramgarh Block: Baret, Baribanj, Kilor, Satoli and Nathuwakan.

<sup>9</sup> Dobriyal, Manmohan J.R. "Why Cutting down Chirpine is not a Solution to Uttarakhand Forest Fires." *DownToEarth.org*, 21 Sept. 2015. Accessible at: <https://www.downtoearth.org.in/blog/forests/why-cutting-down-chirpine-is-not-a-solution-to-uttarakhand-forest-fires-51178>.

**TABLE 4: NUMBER OF RESPONDENTS PER VILLAGE IN NAINITAL DISTRICT**

Nainital	No. of respondents
Baret	27
Baribanj	20
Kilor	29
Nathuwakan	28
Satoli	31
<b>Total</b>	<b>135</b>

**Gender distribution**

Among 135 respondents, 96 (71%) were women and 39 (29%) were men. The project intentionally sought increased participation of women, resulting in a higher amount of women involvement.

**Age distribution**

A majority of respondents for this study were in the age group of 31-40 (29%) and 41-50 (37%) years of age. Apart

from this, 16% of respondents were below the age of 30 while 19% of respondents were above the age of 51.

**Occupational profile**

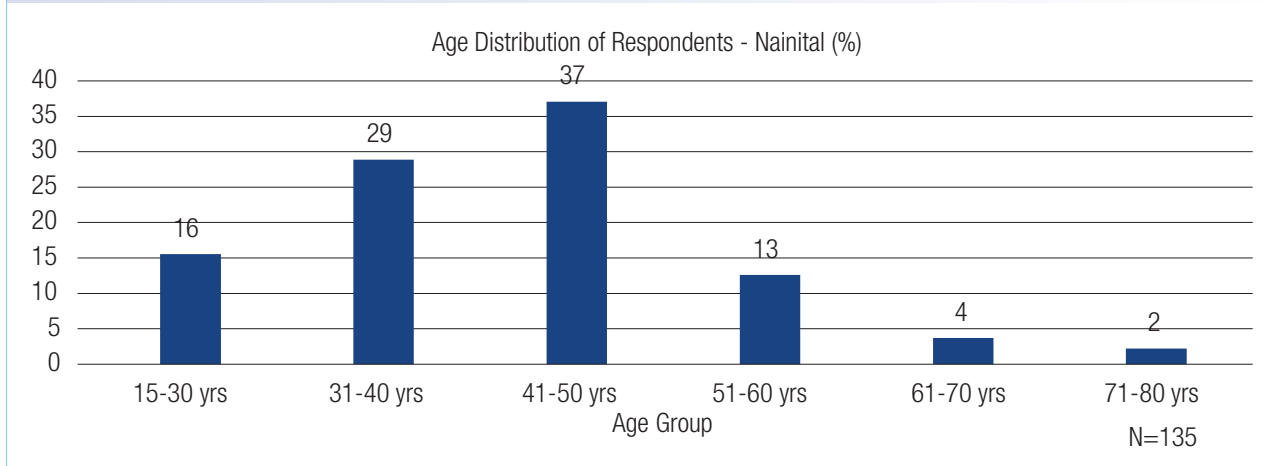
The overwhelming occupation among respondents of this survey was agricultural. A total of 91% of respondents in Nainital were primarily engaged in agricultural work as their means of livelihood. Around 5 % of respondents reared livestock as their primary source of income, while a marginal percentage of respondents were either in govt or private jobs, or unemployed.

**Finding 1: Inclusivity in beneficiary selection:** The program was able to secure a higher involvement of women in these plantations efforts. Additionally, the representation of beneficiaries from older age groups also promoted inclusivity through the program.

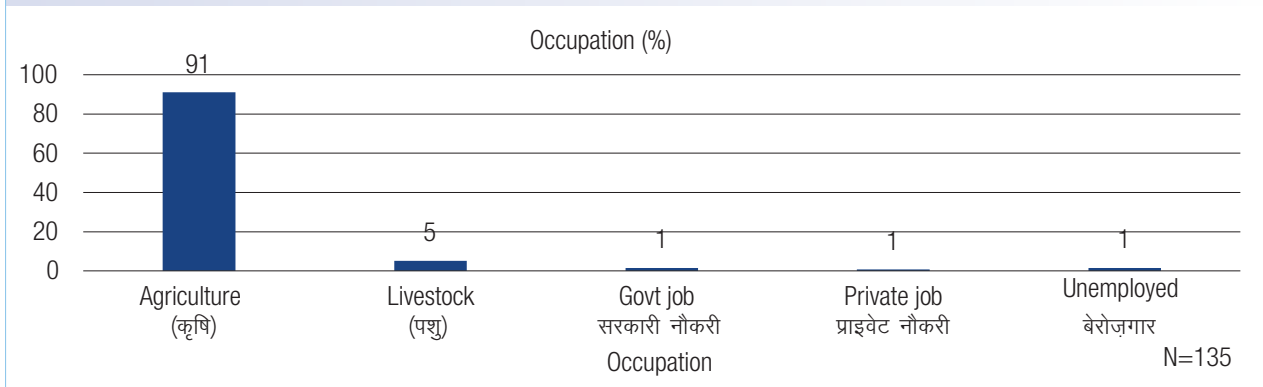
**Plantations details - Nainital**

The study team observed plantations in five villages, Nathuwakan, Baribanj, Bareth, Satoli and Kilor.

**FIGURE 6: AGE PROFILE OF RESPONDENTS**



**FIGURE 7: OCCUPATION PROFILE OF RESPONDENTS**



**FIGURE 8: SATELLITE IMAGE OF NATHUWAKAN SITE IN FEB 2019 (LEFT) AND FEB 2024 (RIGHT)**



### ***Nathuwakan Plantation***

Located at around 1800m above sea level, Nathuwakan housed the largest plantation effort under this program. A total of 48,000 trees were planted in two sites near the village of Nathuwakan. Above is a comparison of satellite images of the Nathuwakan plantation sites.

The images show a distinct change in environmental health over the years. Primarily the heavily reduced canopy cover can be observed in the image on the right. Moreover, the soil health has also undergone significant degradation due to forest fires and surface runoff.

The study team employed the quadrat method to verify trees in Nathuwakan. Since trees were planted through gap filling, the spacing between plants were not uniform. To compensate for this, the study team designated 2 quadrats in the site, 2 Ha. 1,040 trees were surveyed through this method of the total 42,000 trees planted.

### **Tree species**

Among the seven tree species proposed in Nainital four were observed during site visits. Tree species that were not spotted included Bhimal, Bhatula and Kachnar. Bhimal was not spotted due to only 340 Bhatula trees being planted across the plantation site. Bhimal and Kachnar were planted on the site not surveyed by the team.

**TABLE 5: NATHUWAKAN SITE PROFILE**

<b>Name of village</b>	Nathuwakan
<b>Number of sites</b>	2
<b>Plantation land</b>	Van Panchayat
<b>Soil type</b>	Mixed
<b>Number of trees proposed</b>	42,000
<b>Area surveyed</b>	2 hectares
<b>Number of trees surveyed</b>	1,040

### **Plantation health and survival**

Trees planted in Nathuwakan demonstrated good health. Since these trees were planted as an afforestation effort, they were not regularly watered. Owing to this, the growth of these plants would be much slower and hence display smaller heights and spreads. Despite this, however, a very high survival rate of over 95% was observed through the sample across species. Padam recorded the highest survival rate (98%) while the lowest was observed in Bakain plants (92%).

**TABLE 6: NATHUWAKAN SPECIES COUNT AND HEALTH ASSESSMENT**

Species	Number of trees counted (Nos)	Healthy trees (Nos)	Dead planting (Nos)	Mortality rate (%)	Survival Rate (%)
Banj	400	380	20	5	95
Bakain	240	220	20	8	92
Falyat	200	190	10	5	95
Padam	200	195	5	3	98
<b>Total</b>	<b>1040</b>	<b>985</b>	<b>55</b>	<b>5</b>	<b>95</b>

### Baribanj plantation

Situated at around 1,652m above sea level, the site in Baribanj contained 10,000 trees planted under this program. One site was selected in a forest area in proximity of the village that spanned a total of 20 Ha. Below is a comparison of the satellite images of the plantation site in Baribanj.

The green cover and soil texture at this site have visibly deteriorated over time. Notably, a significant gap in the canopy and foliage cover is evident at the center of the image. This gap has noticeably expanded since the 2019 satellite image on the left. Plantation efforts in Baribanj

**TABLE 7: BARIBANJ SITE PROFILE**

<b>Name of village</b>	Baribanj
<b>Number of sites</b>	1
<b>Plantation land</b>	Van panchayat
<b>Soil type</b>	Mixed
<b>Number of trees proposed</b>	10,000
<b>Number of tree species proposed</b>	12
<b>Area surveyed</b>	2 hectares
<b>Number of trees surveyed</b>	200

focused primarily on addressing this gap, along with filling other smaller gaps in its vicinity.

### Tree Species

Despite being a relatively smaller plantation, the plantation in Baribanj had the highest species diversity of any plantations in Uttarakhand. A total of 12 species were proposed to be planted here, of these, the study team observed a total of 9. Sanad, Tilonj, and Karak were not spotted since these were planted in lesser numbers.

The name of the village, Baribanj, comes from the Banj forests that surround it. However, in recent times due to land degradation, forest fires and pine trees, these Banj forests have been in decline. In an effort to rejuvenate these forests, a much higher number of Banj trees were planted in this site.

### Plantation health and survival

The plantation in Baribanj had a high survival rate across most species with an average of 90%. Most notably, the highest survival rate among these trees was noticed in Banj trees (96%), while the lowest survival rate was for Bhatula and Kachnar (80%). These mortalities were mostly due to wild animals such as porcupines and boars.

**FIGURE 9: SATELLITE IMAGES OF BARIBANJ SITE AREA IN FEB 2019 (LEFT) AND FEB 2024 (RIGHT)**



**TABLE 8: BARIBANJ SPECIES COUNT AND HEALTH ASSESSMENT**

Species	Number of trees counted (Nos)	Healthy trees (Nos)	Dead planting (Nos)	Mortality rate (%)	Survival rate (%)
Banj	50	48	2	4	96
Bhatula	20	16	4	20	80
Kanol	20	18	2	10	90
Kachnar	10	8	2	20	80
Falyat	30	28	2	7	93
Padam	30	27	3	10	90
Bhimal	5	5	0	0	100
Sakaina	30	25	5	17	83
Utis	5	5	0	0	100
<b>Total</b>	<b>200</b>	<b>180</b>	<b>20</b>	<b>10</b>	<b>90</b>

### Bareth plantation

Located around 1650m above sea level, afforestation efforts were undertaken in a site adjacent to the Bareth village under this program. The site near Bareth village spanned 35 Ha, where 10 species of trees were proposed to be planted totalling 25,000 trees.

Similarly, as noticed in below plantation sites, both green cover and soil texture show signs of degradation over the years. Gaps in canopy cover are also significant in this site area.

**TABLE 9: BARETH SITE PROFILE**

<b>Name of village</b>	Bareth
<b>Number of sites</b>	1
<b>Plantation land</b>	Van Panchayat
<b>Soil type</b>	Rocky
<b>Number of trees proposed</b>	25000
<b>Number of proposed tree species</b>	10
<b>Area surveyed</b>	3.5 Hectare
<b>Number of trees surveyed</b>	1035

The study team employed the quadrat method in Bareth covering an area of 3.5 Ha and surveying 1,035 trees.

### Tree species

Out of the 10 proposed tree species in Bareth, the study team observed five. Bhatula, Sanad, Kanol, Panar and Bhimal trees were not spotted as only a small number of these tree species were planted in Bareth.

Out of the 2,500 trees planted in this site, 9,550 were Kachnar trees. This was done in consultation with van panchayat members who suggested that Kachnar trees do not only have ecological relevance to the area, but also have important medical properties utilised by community members in the village.

### Plantation health

The plantation in Bareth also showcased a very high survival rate of around 95% across species. The highest survival rate was recorded in Banj trees (97%) while the lowest survival rate was observed in Padam trees (93%).

**FIGURE 10: SATELLITE IMAGE OF PLANTATION SITE IN BARETH IN FEB 2019 (LEFT) AND FEB (2024) (RIGHT)**



**TABLE 10: BARETH SPECIES COUNT AND HEALTH ASSESSMENT**

Species	Number of trees counted (Nos)	Healthy trees (Nos)	Dead planting (Nos)	Mortality rate (%)	Survival Rate (%)
Banj	320	310	10	3	97
Bakain	194	186	8	4	96
Kachnar	325	310	15	5	95
Falyat	150	143	7	5	95
Padam	46	43	6	13	93
<b>Total</b>	<b>1035</b>	<b>992</b>	<b>46</b>	<b>6</b>	<b>95</b>

### Satoli plantation

Located at a higher altitude of around 1900m above sea level, the plantation in Satoli was the smallest afforestation drive under this program in Uttarakhand. 3,500 trees were proposed to be planted across 15 Ha of land. Below is a comparison of satellite images of the plantation site in Satoli.

The forest area captured in these satellite images shows a similar decline in canopy cover and soil texture as the others.

**TABLE 11: SATOLI SITE PROFILE**

<b>Name of village</b>	Satoli
<b>Plantation land</b>	Van Panchayat
<b>Number of plantation site</b>	1
<b>Soil type</b>	Rocky
<b>Number of proposed trees</b>	3500
<b>Number of proposed tree species</b>	7
<b>Area surveyed</b>	1 Hectare
<b>Number of trees surveyed</b>	255

The reduction in canopy cover of the Satoli site, however, is much more pronounced and spread across the forest. Tree plantations in Satoli were done in these gaps aiming at increasing the green density of the area.

The study team employed the quadrat method to survey the plantation site in Satoli. Through this quadrat, 1 Ha of area was covered where 255 trees were observed.

### Tree species

A total of seven tree species were proposed to be planted in Satoli. All seven species were observed on this site.

### Plantation health and survival

The plantation in Satoli demonstrated an exceptional survival rate across various species, with Falyat, Padam, Sakin, and Kachnar trees all achieving a remarkable 100% survival rate based on the sample. However, Bhatula trees showed a slightly lower survival rate of 80%, attributed to the challenges posed by higher altitude and decreased soil water capacity. Despite these factors, the survival rate of Bhatula trees remains commendable.

**FIGURE 11: SATELLITE IMAGE OF PLANTATION SITE IN SATOLI IN FEB 2019 (LEFT) AND FEB 2024 (RIGHT)**



**TABLE 12: SATOLI SPECIES COUNT AND HEALTH ASSESSMENT**

Species	Number of trees counted (Nos)	healthy trees (Nos)	Dead planting (Nos)	Mortality rate (%)	Survival Rate (%)
Banj	100	96	4	4	96
Bhatula	10	8	2	20	80
Bakain	60	55	5	8	92
Falyat	20	20	0	0	100
Padam	50	50	0	0	100
Sakaina	5	5	0	0	100
Kachnar	10	10	0	0	100
<b>Total</b>	<b>255</b>	<b>244</b>	<b>11</b>	<b>4</b>	<b>96</b>

### Kilor plantation

Kilor is situated in the lowest altitude among the intervention villages in Nainital at around 1400m. On this site, 20,000 trees across 7 species were proposed to be planted along a 30 Ha site. Below is a comparison of satellite images of the Kilor site. The satellite images show little difference between the years of 2019 and 2024 in Kilor.

**TABLE 13: KILOUR SITE PROFILE**

<b>Name of village</b>	Kilour
<b>Number of sites</b>	1
<b>Plantation land</b>	Van Panchayat
<b>Soil type</b>	Hilly alluvial
<b>Number of trees proposed</b>	20000
<b>Number of proposed tree species</b>	7
<b>Area surveyed</b>	3 Hectare
<b>Number of trees surveyed</b>	780

The study team employed the quadrat method to survey the plantation site in Kilour. Through this method, 3 Ha of area was covered where 780 trees were observed.

### Tree species

A total of seven tree species were proposed to be planted in Kilour. The study team observed five of these seven species. Additionally, the study team also observed Amla trees on the plantation site, while these were not proposed, both beneficiaries and representatives of Chirag Foundation confirmed that Amla trees were planted under this program.

### Plantation health and survival

The survival rate of trees in Kilour also remained high as with other sites. The average survival rate across species was 95%, highest survival rate was observed in Amla and Falyat trees at 100%, while the lowest survival rate was found in Bakain and Kachnar trees at 90%.

**FIGURE 12: SATELLITE IMAGES OF PLANTATION IN KILOUR IN JAN 2019 (LEFT) AND FEB 2024 (RIGHT)**



**TABLE 14: KILOUR SPECIES COUNT AND HEALTH ASSESSMENT**

Species	Number of trees counted (Nos)	healthy trees (Nos)	Dead planting (Nos)	Mortality rate (%)	Survival Rate (%)
Banj	300	290	10	3	97
Bakain	150	135	15	10	90
Kachnar	200	180	20	10	90
Falyat	100	100	0	0	100
Padam	20	19	1	5	95
Amla	10	10	0	0	100
<b>Total</b>	<b>780</b>	<b>734</b>	<b>46</b>	<b>5</b>	<b>95</b>

### Findings from the plantations - Nainital

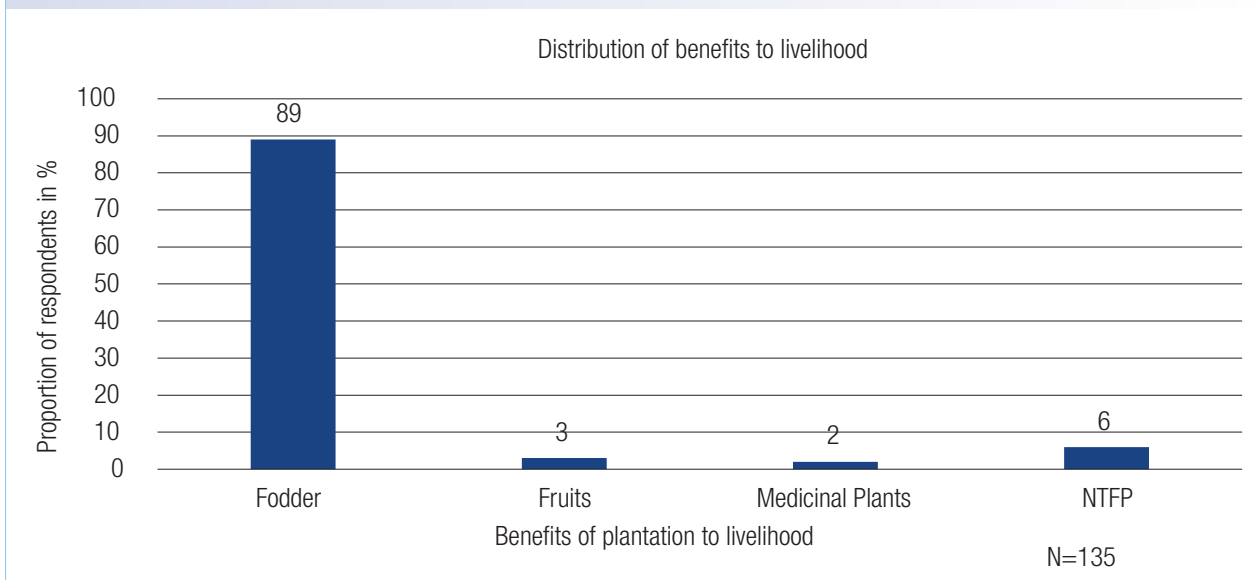
**Finding 1 – Local and relevant species planted:** Tree species were selected for plantation in close consultation with community members and van panchayats. As such, all the trees planted were locally relevant both, ecologically and socio-economically. Tree species such as Bakain, Banj and Bhatula provide fodder for livestock rearing, tree species such as Falyat and Padam have high rates of carbon sequestration while others provide various benefits such as medicinal or to produce agroforestry products. Beneficiaries and community members noted that the primary use of these trees would be for fodder, however a small percentage were aware and willing to utilize other

livelihood benefits provided by the trees through fruits, medicinal value or NTFPs.

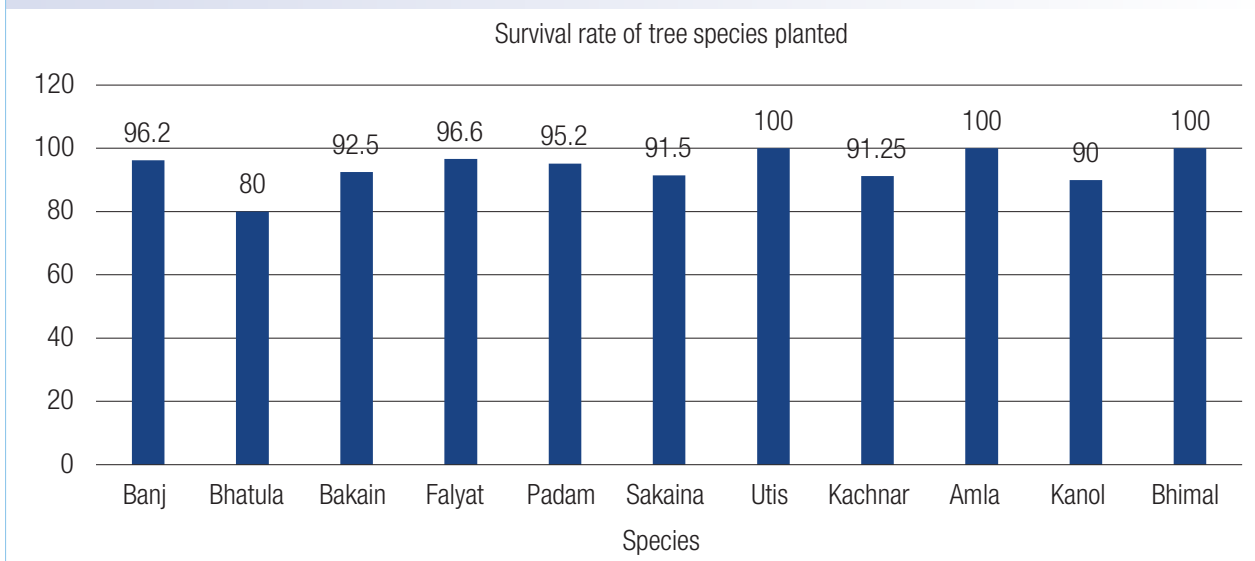
**Finding 2 – High plant survival rates:** High survival rates were observed across all plantation sites in Nainital, with the lowest being observed in Baribanj at 90%. Below is a graph representing the survival rate across species observed in Nainital.

Among these species, Banj, Falyat and Padam trees reliably showed the highest survival rates. While Bhimal, Amla and Utis trees have 100% survival rates, these were only observed in smaller numbers.

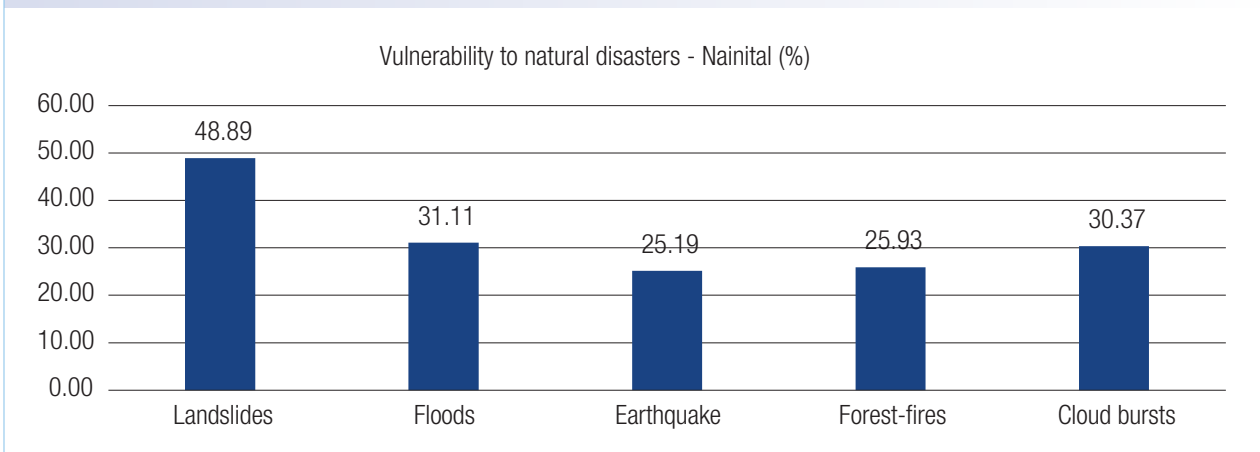
**FIGURE 13: LIVELIHOOD BENEFITS TO BENEFICIARIES**



**FIGURE 14: SURVIVAL RATE OF TREE SPECIES PLANTED**



**FIGURE 15: VULNERABILITY TO NATURAL DISASTERS**



Notably, the survival rate of these plantations has increased substantially since 2023. Through interaction with community members and implementing partner, the study team was able to credit this increase of survival to **replantation, which was carried out in 2023**. These replanted trees were also observed throughout the site visits by its distinction in the height and spread of the plants.

**Finding 3 – Trees for ecological restoration:** As the main objective of these plantations was to reclaim degraded land, the trees were planted exclusively in canopy cover gaps. This was done to restore those degrade patches of land.

Furthermore, Pine trees are an invasive species in the Kumaon region. The adversities presented by pine trees include forest fire vulnerability due to the flammable nature of pine needles and pinecones, reduced water retention of soil leading to land degradation. To counteract this, ecologically relevant trees were planted in these sites to improve the ratio of native trees. Banj trees were especially planted in higher numbers for this purpose.

**Finding 4 – Trees to mitigate natural disasters:** A key objective of this project was to mitigate the damages caused by natural disasters. To study also sought to understand the prevalence of natural disasters in the area. Above is a graph depicting the vulnerability to different natural disasters according to survey respondents.

Respondents reported landslides as the most common natural hazard (48.89%) followed by flooding (31.11%) and cloud bursts (30.37%), while earthquakes (25.19%) and forest-fires (25.59%) were also cited.

When further questioned about the role of the plantations in disaster risk mitigation **31% of respondents noted**

**that these trees would aid in reducing the adversities** presented by these disasters.

**Finding 5 – Khaal development for water conservation:** Khaals were constructed in each intervention villages of Nainital to improve water retention of soil by capturing and storing rainwater and reducing surface runoff. Khaals were also strategically constructed for maximum water conservation near the plantation sites. The table below enumerated the number of khaals constructed in each village.

**TABLE 15: NUMBER OF KHAALS CONSTRUCTED IN EACH VILLAGE**

Village name	Number of Khaals constructed
Satoli	4
Kilor	3
Baret	4
Nathuwakan	1
Baribanj	3

**FIGURE 16: KHAL IN BARIBANJ**



### Process for program implementation in Nainital

Chirag Foundation, the local implementing agency has extensive experience in afforestation efforts with the intervention villages. As such, the strategies employed for these plantations were largely alike. Below is a graphic representing the implementation process of the plantation drive in Nainital.

**Finding 1 – Effective community sensitization:** The implementing agency Chirag Foundation utilized carefully planned awareness efforts in to generate demand within the community. Almost all respondents confirmed participating in awareness generation activities prior to the plantation. Community meetings were held to sensitize communities about the hazards of deforestation and the benefits that forests provide through fodder and other livelihood products such as fruits, oils and aromatics.

**Finding 2 – In house nurseries:** Nursery activities were not restricted to a singular location, but instead each beneficiary was provided seeds to develop nurseries in their homes. Qualitative interactions with community members revealed that this nursery development process not only helped them to understand the tree plantation better, but caring for the seeds and saplings also made them emotionally attached to their saplings. This strategy fostered community ownership,

not only for direct beneficiaries of the program, but also for their families, in whose homes the nurseries were developed.

### Finding 3 – Community driven approach to plantations:

Despite direct beneficiaries being selected for the program, community meetings were held for everyone for discussions ranging from program planning, activities orientation, monitoring and exit strategy. As such, most community members were actively invested in the plantation process, and aided in pit digging, field preparation, sapling transfer and maintenance as well.

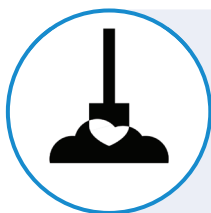
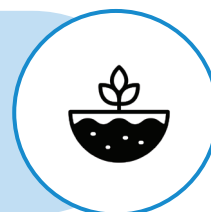
Selection of site and species was done in close consultation with gram panchayat and van panchayat members to ensure relevance of the program and secure their active participation. The table below represents survey respondent’s recollection of stakeholders involved in the site and species selection process.

The table 16 illustrates the instrumental role played by the van panchayat members played in selection of site and species.

Additionally, maintenance for the plantations was also done by community members as planned by Chirag in coordination with the community. Chirag conducts regular site visits (once a week) to monitor plantation health and provide support to

#### Nursery Development

- Sowing of seeds in small polybags containing good quality soil
- Nursery was prepared by beneficiaries in their homes in December
- Nursery/ saplings were covered by cloth or hay to ward off monkeys and boards from eating them



#### Field preparation

- After site identification, pits were dug in areas where there was gaps in canopy cover
- Pit digging activities were carried out immediately after the first rains. This was done as the soil would have been primed to make preparation easier

#### Sapling transfer

- Placing saplings in pits in early to mid July (monsoon)
- Carrying out regular watering of plants



#### Monitoring and maintenance

- After plantation joint efforts of the community were held for monitoring and maintaining good condition of plants. Regular visits made by sarpanch as well
- Replantation was carried out for dried and dead plants

**TABLE 16: STAKEHOLDER INVOLVEMENT IN THE PLANTATION**

Stakeholders involved in selection	Site selection (%)	Tree species selection (%)
Implementing partner and van panchayat	10.37	10.37
Implementing partner and gram panchayat	5.93	5.93
Gram panchayat	2.22	2.22
Implementing partner	5.19	4.44
Van panchayat	74.81	75.56
Not aware	1.48	1.48

community members in maintenance.

**Finding 4 – Pre-emptive replantation measures:** For the first round of plantations, Chirag Foundation supplied 10% extra seeds to beneficiaries in charge of nursery development. This was done so that, in case dead planting was found, community members would be able to actively replant the trees. This allowed the community to have agency in ensuring replantation of dead/dried trees could be carried out as soon as possible.

**Finding 5 – Record keeping of plantations:** Both, Chirag Foundation and PRI members of intervention villages kept records for the plantation. Chirag foundation kept records for seed provisions, number and species of trees planted and replanted as well as remuneration provided to beneficiaries under each activity. PRI members recorded information pertaining to beneficiary involvement and remuneration disbursement.

#### Site Specific Findings

**Bareth – Alternative plantation strategy:** Severe water and land shortage in the area left many community members deterred from participating in nursery development. As such, Chirag foundation developed a smaller nursery within the village for community members to participate in while procuring and nursing the rest of the plants in a separate location. Out of the 25,000 trees planted in Bareth, 5,000 were grown in the local nursery. Furthermore, labourers from outside the village were hired for pit digging in Bareth; these labourers were hired by the sarpanch. As such, remunerations provided to beneficiaries under the program were considerably lower than those provided in other villages at the rate of Rs 2.75 per sapling.

#### People involved in the program - Nainital

**Finding 1 – Engaged and active implementing partner:** With significant experience in afforestation initiatives in the

area, Chirag Foundation was well-prepared for this program. They actively engaged communities through consistent communication with the sarpanch of each intervention village and organized community meetings and awareness drives to educate community members about environmental degradation and the importance of tree planting.

Chirag Foundation also conducted regular site visits to supervise and support the plantation efforts in each village. Furthermore, following the conclusion of program activities, Chirag Foundation continued to make site visits ensuring proper monitoring after completion. Interactions with community members and the sarpanch reflected the trust placed in Chirag Foundation. Beneficiaries of the program also reported the timely disbursal of remuneration, facing no issues on that front.

#### Finding 2 – Community attuned to their forest:

Qualitative interactions with community members highlighted their connection with the forest areas surrounding their

#### Tree planting: A cause for celebration

In the Kumaon region an annual celebration known as 'Harela', the Day of Green, is celebrated. Traditional practice involves sowing seeds 10 days prior to the harela festival day and celebrating when the seeds sprout. However, in June of 2022, community members of the intervention villages celebrated Harela on the plantation sites, as plants were being transported from nurseries to pits. Community members would gather around the plants and engage in song and dance, praying for the healthy growth of their plantation. As part of the celebration, dishes such as kheer, puri, chole and other dishes were also prepared to celebrate these efforts as a step towards rejuvenation of their forests.

### Community owned and community protected trees

In 2023, Reena (name changed) noticed the plantation in Baribanj ablaze. She immediately ran down to notify the sarpanch. In a matter of minutes, 25 residents of Baribanj had mobilized and rushed down to the site in order to extinguish the fire. Some members grabbed buckets and filled them with sand, while others picked up large leaves to douse the fire with. Reena recalled that the process of snuffing out the fire took hours, but they were able to do so without the plantation sustaining too much damage. Despite the disaster, Reena remembers the event pleasantly as it reassured her that her community would ensure no harm would come to their plants.

villages. They noted that forests not only provide a home for themselves and local flora and fauna but impart crucial livelihood benefits that they rely on. Most integrally, fodder for livestock and medicinal products from trees. Others noted that trees such as Amla also provide sustenance and agroforestry-based livelihood. This link between communities and their surrounding ecology ultimately fosters a responsibility that many communities feel towards the protection and safeguarding of their forests.

#### **Finding 3 – Strong community ownership of plantation:**

Residents of intervention villages felt a strong sense of ownership towards their plantations. Despite only a handful of community members being direct beneficiaries of the program (received remuneration for their efforts), almost all community members aided in processes such as pit digging, sapling transfer and maintenance of the plantation sites voluntarily.

Notably, however, community members had a limited understanding of their role in protecting local forests, leading to inaction in forest conservation efforts. Currently, van panchayat members have taken little to no effort to protect forest areas, while community members continue to send their animals grazing in degraded land.

#### **Finding 4 – Inclusivity and upliftment of marginalized groups in beneficiary selection:**

Beneficiaries for the program were chosen in collaboration with PRI members and the local community. It was determined that households from economically disadvantaged backgrounds in each village would receive economic assistance from the plantation

initiatives. Additionally, women were exclusively chosen as *beneficiaries for nursery development*, aiming to empower them within these communities. Renumeration for activities was also provided via bank transfer directly to beneficiary bank accounts. As such female beneficiaries received remuneration directly.

#### **Sustainability of program - Nainital**

Study respondents highlighted the consultative and participatory nature of the program in Nainital. Van panchayat members, PRI members and the community were consulted on details of the program including site selection, tree species selection, development of Khaals and beneficiary selection.

**Finding 1 – Ownership transfer of plantation:** Succeeding the plantation program in each village, ownership of the sites and trees was swiftly transferred to the community, with prime responsibility given to the Sarpanch. Sarpanch and community members are responsible for the maintenance and upkeep of plantations in their villages. They were also responsible for recording and reporting dead planting to Chirag Foundation to inform replantation efforts.

#### **Finding 2 – Lack of protection from wild animals:**

Currently, most sites in Nainital are vulnerable to local wildlife. Porcupines, wild boars and monkeys present the largest threat to the survival of planted trees. Many communities have requested aid from Chirag Foundation in setting up a fence around the site. Of these sites, only Baribanj and Satoli has a partial wire fence set up, which was done through their own funds.

#### **Finding 3 – Rainfed plantations:**

Irrigation of plantations is primarily rainfed. This means that during drought conditions, the planted trees get minimal irrigation. To counteract this, Khaals were strategically planned and constructed around the plantation sites to capture and store rainwater to ensure minimal runoff.

#### **Finding 4 – Lacking visibility of plantation sites:**

Most plantation sites do not have signboards or fencing around the plantation perimeters resulting in reduced visibility of plantation.

### 3.2.2 Naugaon, Uttarkashi

For the impact assessment study in Uttarkashi, two villages were sampled. Here, 19 surveys were conducted with direct beneficiaries of the program, i.e., those community members involved in plantation efforts and received livelihood benefit. Parallely, the study team also conducted FGDs with

beneficiaries, community members and interviews with PRI members and implementation partners, as well as physical verification of 2 sites.

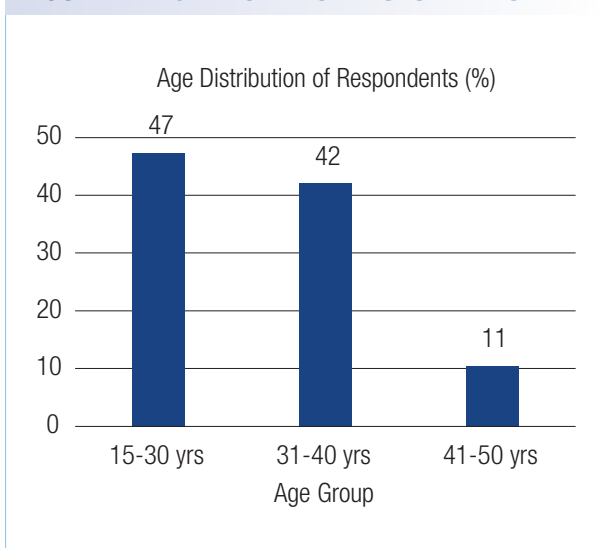
*As mentioned above, the study team was unable to carry out surveys in Sunara as community members were not available.*

The key findings for the program in Uttarkashi will be presented separately for each location. This was done as there is stark contrast between the implementation and impact of the program between both sites, making it challenging to draw common insights.

### Respondent Profile

Below is the demographic profile of respondents of the survey in Lodan. All 19 beneficiaries from the project were surveyed for this study.

**FIGURE 17: AGE PROFILE OF RESPONDENTS**



### Gender distribution

Among the 19 respondents, 12 (63.2%) were women while 7, (36.8%) were men. Under the project's mandate, women were to be prioritized as direct beneficiaries of the project.

### Age distribution

Similar to Nainital, the program sought to involve significant number of women (63%) in plantation as direct beneficiaries.

### Occupational profile

Significant number of younger people in the age group 15-30 and 31-40 are involved in the plantation project, which depicts their enthusiasm to contribute towards protecting the forests and to raise awareness regarding plantations.

### Plantation details - Uttarkashi

The study team observed plantations in two intervention villages in Uttarkashi, Lodan and Sunara.

### Lodan plantation

Situated at around 1700m above sea level, 25,000 trees were proposed to be planted in the village of Lodan. On this site, 6 species of trees were to be planted on 35 Ha of forest land. The images below are a comparison of the satellite images of the plantation site in Lodan.

The images below show a clear improvement in the green cover of the area due to the plantation efforts. The outcome of the plantations in Lodan is much clearer due to the absence of any canopy cover in the area.

The study team employed the quadrat method to survey the plantation site in Lodan. Two quadrats were identified for this site as tree density varied across the plantation area. Combining both quadrats, a total area of 2.5 Ha were covered and 675 trees were surveyed.

**FIGURE 18: SATELLITE IMAGE OF PLANTATION SITE IN LODAN IN FEB 2019 (LEFT) AND FEB 2024 (RIGHT)**



**TABLE 17: LODAN SITE PROFILE**

Name of village	Lodan
Number of sites	1
Plantation land	Van Panchayat
Soil type	Rocky
Number of trees proposed	25000
Area surveyed	2.5 Hectares
Number of trees surveyed	675

**Tree species**

Six tree species were identified to be planted on the Lodan plantation sites. Of these six species, five were observed on site. Guava/ Amrud trees were not observed as the mortality of these trees was nearly 100%.

**Plantation health and survival**

From the observed sample, the overall survival rate of the plantation in Lodan was 83.6%. Silver oak trees showcased the highest survival rate (95.2%), followed by Deodhar (88.5%) and Banj (87.7%). The lowest survival rate was recorded in Amla trees (31.2%).

**TABLE 18: LODAN SPECIES COUNT AND HEALTH ASSESSMENT**

Species	Number of trees counted (Nos)	Healthy trees (Nos)	Dead planting (Nos)	Mortality rate (%)	Survival rate (%)
Deodhar	174	154	20	11.5	88.5
Amla	77	24	54	70.1	31.2
Silver Oak	231	220	12	5.2	95.2
Reetha	39	31	8	20.5	79.5
Banj	154	135	20	13.0	87.7
<b>Total</b>	<b>675</b>	<b>594</b>	<b>114</b>	<b>16.9</b>	<b>83.6</b>

**Sunara plantation**

Situated 1300m above sea level, 25,000 trees were proposed to be planted in the village of Sunara. On this site, 6 species of trees were to be planted across a 35 Ha plantation site.

The study team employed the quadrat method to survey the site in Sunara. Through the quadrat method, 0.5 Ha were covered, where 50 trees were surveyed.

**TABLE 19: SUNARA SITE PROFILE**

Name of village	Sunara
Number of sites	1
Plantation land	Van Panchayat
Soil type	Rocky
Number of trees proposed	25000
Area surveyed	0.5 Ha
Number of trees surveyed	50

**Tree species**

Of the six proposed species, three were sighted during the site observation in Sunara. While Banj trees were not proposed to be planted on the site, they were observed on site.

**Plantation health and survival**

The plantation health in Sunara was comparatively lower than those observed in other sites. This was especially true for Jamun trees, where the mortality was 100%. The overall survival rate of plantations in Sunara was 70%.

**FIGURE 19: SATELLITE IMAGE OF PLANTATION SITE IN SUNARA IN FEB 2019 (LEFT) AND FEB 2024 (RIGHT)**



**TABLE 20: SUNARA SPECIES COUNT AND HEALTH ASSESSMENT**

Species	Number of trees counted (Nos)	Healthy trees (Nos)	Dead planting (Nos)	Mortality rate (%)	Survival rate (%)
Deodhar	10	5	5	50	50
Silver Oak	20	18	2	10	90
Banj	15	12	3	20	80
Jamun	5	0	5	100	0
<b>Total</b>	<b>50</b>	<b>35</b>	<b>15</b>	<b>30</b>	<b>70</b>

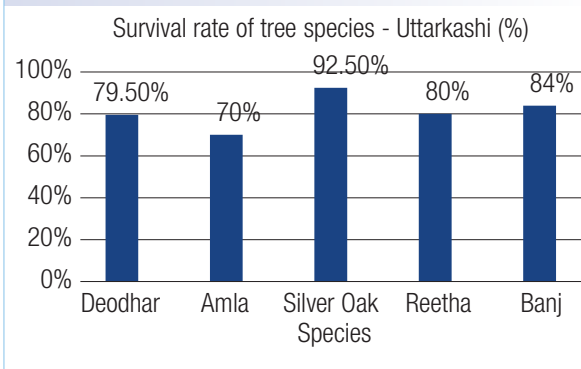
**Findings from plantations - Uttarkashi**

**Finding 1 – High survival rates in Lodan:** The survival rate for plantations in Lodan were relatively high at nearly 84% across all species. The highest survival rate was seen among Silver oak (92.5%) due to their hardy nature, this was followed by Banj trees (84%) and Reetha trees (80%). Guava trees which were planted in Lodan had a negligible survival. Community members highlighted that they were unaware that the plantations soil conditions were not conducive to the growth of Amla trees and as such most of them dried out in the first year.

**Finding 2 – Lower survival rate in Sunara:** The survival rate observed in the Sunara plantations was considerably lower than those observed in Lodan or any of the Nainital plantations. While the overall survival rate observed in Sunara

through site observations was 70%, clear demarcations of site area or pits were not visible, which made it challenging to identify plants under the program.

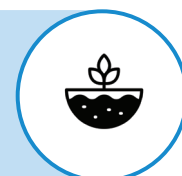
**FIGURE 20: SURVIVAL RATE OF TREE SPECIES**



**PROCESS OF PROGRAM IMPLEMENTATION - UTTARKASHI**

**Nursery Development**

- Sowing of seeds in small polybags containing good quality soil
- Nursery was prepared in a separate location in a different village, was not done by community members



**Field preparation**

- Pit digging was done in the week following the first rains

**Sapling transfer**

- Saplings were transported to village via road
- Sapling transfer and plantations in the pit were done by male and female beneficiaries



**Monitoring and maintenance**

- After plantations a Suraksha Samiti was constituted by the PRI consisting of two men and one woman to look after and monitor the plantation as they live nearby the plantation site.
- Replantation was carried out for dried and dead plants

**Finding 1 – Plantation site:** The site selection process for Lodan was a collaborative effort involving community members, van panchayat, and PRI representatives. This was facilitated through community meetings. This ensured that the chosen site aligned with the community's needs and the local ecology, making it both relevant and sustainable. On the other hand, the selection of Sunara's site was less than ideal. Positioned along the main road, this location had become a popular spot for community members to engage in activities such as smoking and drinking.

**Finding 2 – Outsourced nursery development:** Nursery development was conducted in a separate location in the intervention villages of Nainital. Two concerns emerged through this process. Firstly, since community members were not involved in nursery development, beneficiaries worked for a reduced period on the plantation and ultimately generated less livelihood through the program. Secondly, a significant percentage (between five – 15% according to beneficiaries) of saplings would be lost in transit between the nursery and the plantation site.

Noteworthy, for subsequent plantations, an in-house nursery was developed in Lodan. The community members have been involved in nursery activities since then.

**Finding 3 – Community group for plantation maintenance in Lodan:** A "Suraksha Samiti" or protection committee was constituted in Lodan for maintenance and upkeep of the plantations. The committee members volunteered for the role due to the proximity of the plantations to their fields. As part of this committee, they frequently monitor the plantations to inspect damage to the plantations by wildlife or domestic animals. Furthermore, a biannual counting is conducted to identify dead planting to be reported to the local implementing partner for replantation.

**Finding 4 – Poor maintenance of plantation site in Sunara:** During site observations, the study team noticed several burned patches of land, discarded beverage can, snuffed out cigarettes and snack wrappers. Additionally, trees planted under the program were also grazed upon by livestock. The plantation site in Sunara was severely neglected.

## **People involved in the program - Uttarkashi**

**Finding 1 – Limited community sensitization:** One of the key mandates of this program, was awareness generation and sensitization of community members. It was found that limited community sensitization was carried out in Lodan and Sunara. As a result, awareness surrounding the importance of ecological conservation and their practices were reduced among community members. This was especially true for Sunara, where community members regularly burned patches of the forest in order to regrow grass and fodder for their livestock.

**Finding 2 – varied community attitudes:** The communities in Lodan and Sunara exhibited distinct attitudes towards plantation efforts, indicating varying levels of engagement and ownership. In Lodan, community members demonstrated a sense of ownership towards the plantation sites, actively participating in monitoring and upkeep activities. This high level of involvement suggests a strong attachment to the conservation effort and a willingness to assume responsibilities for its maintenance.

Conversely, in Sunara, community members displayed a lack of engagement with the site. The area appeared unkempt with waste improperly disposed at the site. Additionally, the community displayed little regard for the health of the plantation. They frequently let their animals graze on the plantation site and even sometimes burnt patches for regrowth. Despite efforts by the implementing partner, full community buy-in for the plantation in Sunara was not achieved, highlighting challenges in securing community support for conservation initiatives in this location.

**Finding 3 – Inactive van panchayats:** In both Sunara and Lodan, it was observed that little to no action had been taken by van panchayats to secure nearby forest land. Frequent man-made forest fires and overgrazing has led to several forest areas becoming degraded. It should be noted however, that following the plantation efforts, some van panchayat members as well as keen community members have begun to take a more active interest in forest protection.

# Impact



Overall, FDP has had a positive impact on the environment, in socio-economic aspects of the community members' and beneficiaries' lives. The project has led to the establishment of community driven governance structures as well. The section below will unpack each of the impact areas in detail.

## 4.1 Environmental Impact

The environmental impact of FDP has been more pronounced in the intervention areas in terms of forest gap reduction, reclamation of degraded land and carbon reduction.

### 4.1.1 Forest gap reduction

#### ***Ramgarh, Nainital***

All the sites for this program were selected in consultation with PRI members, van panchayats and community members. As such, sites were specifically chosen that showed degradation through forest fires or surface runoff. While there has not been any immediate reduction in canopy cover gaps as the trees planted are still in their infancy, considering the average survival rate of trees planted under the program coupled with active replantation efforts, these gaps can be bridged in 12 – 15 years. Furthermore, Banj and Silver oak trees, which were amongst the most abundantly planted under this program, have well documented abilities in reclaiming environmentally degraded land<sup>10</sup>.

#### ***Naugaon, Uttarkashi***

The site selected in Lodan was specifically targeted by the implementing partner in consultation with the van panchayat to address gaps in forest canopy cover. Since the initial plantations in June 2021, 2 more plantation efforts have been initiated around the site to close additional gaps. These plantations have also incorporated learnings from the previous plantations. These included removing Guava trees from subsequent plantations, which were unsuitable for

the soil profile of the area, promoting nursery development within the village to improve efficiency and ensure that community members are the ultimate beneficiary. With more concerted efforts such as this, there will be significant forest gap reduction around Lodan

### 4.1.2 Reclaiming degraded land through soil and water conservation

#### ***Ramgarh, Nainital***

Through the survey, many respondents (72%) noted that plantations in the long- term will result in improvement in soil fertility. During qualitative interactions they stated that plantation are the best way to reduce soil pollution.

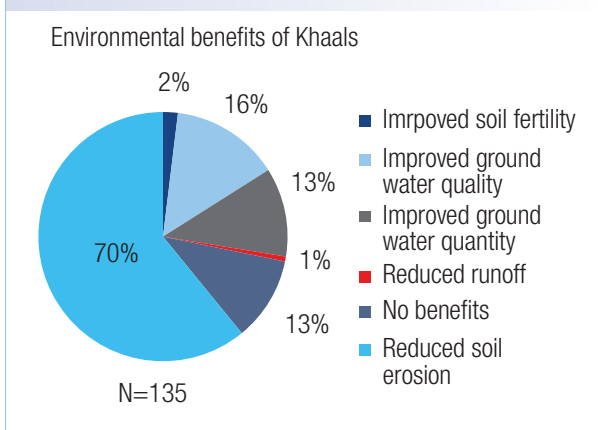
Specifically, Banj, Kachnar and Falyat Trees absorb water, facilitating its absorption into the soil, and prevent soil particles from drying out by transporting water towards their roots through leaves and bark. These Fertilizer trees contribute to soil well-being by taking nitrogen from the air and transferring it to the soil via their roots and leaf debris. Additionally, they can bring nutrients from deeper soil layers to the surface, benefiting crops with shallow roots<sup>11</sup>.

A significant proportion of respondents (62%) also stated that the project will lead to enhanced water quality and availability. Increased plantation efforts improve the effectiveness of forests as natural filters, mitigating the entry of pollutants into water sources. Forests play a vital role in managing the water cycle by regulating precipitation, evaporation, and water flows. The various layers of the forest canopy, branches, and roots have the capacity to store and release water vapor, thereby influencing rainfall patterns (Lyons, n.d.). Although the currently planted trees are in their early stages, as such these effects will only be visible in 12-15 years, upon the maturity of these trees.

<sup>10</sup> Uniyal, A. K. ; Bagwari, H. K. ; Todaria, N. P., 2003. Rehabilitation of abandoned and denuded lands in Garhwal Himalaya through afforestation techniques - a case study. *Indian J. Soil Cons.*, 31 (3): 269-275

<sup>11</sup> <https://forestnation.com/blog/how-soil-fertility-increases-by-planting-trees/>

**FIGURE 21: SURVIVAL RATE OF TREE SPECIES**



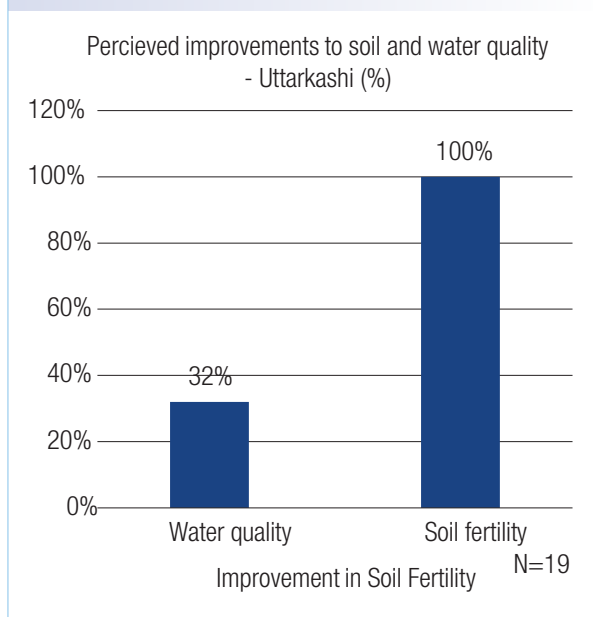
Parallely, Khaals were also constructed on the plantation sites to facilitate water retention of the soil. These khaals have a more immediate impact in not only conserving water by recharging the soil, but also reducing surface runoff. During qualitative interactions, community members highlighted that during and for a while after seasonal rainfall, the Khaals constructed through this program have significantly increased the water availability of the plantation sites, and have subsequently led to the health of the plantations. Survey respondents noted these immediate impacts of the Khaals constructed through this project.

An overwhelming 83% of respondents responded positively towards the environmental benefits of Khaals. Significantly, 70% of respondents suggested reduction of soil erosion around the plantation site as a result, while others, mentioned about its benefits through improved groundwater quality and quantity.

***Naugaon, Uttarkashi***

All respondents of the survey reported observing changes in soil fertility. Additionally, during the qualitative interaction, PRI and community members noticed changes in soil fertility after the plantation. A total of 50,000 trees were proposed in Uttarkashi location. Afforestation is one of the best ways to reduce environmental pollution, such as air pollution, water pollution, soil pollution, etc. Species planted in Uttarkashi were relevant to the local ecology. Deodar and Reetha trees are known for their deep root systems, which can break up compacted soil and improve soil structure. Additionally, the fallen leaves of these species decompose, adding organic matter to the soil and enriching it with nutrients. Species like

**FIGURE 22: IMPROVEMENT IN SOIL FERTILITY**



Banj and silver oak have extensive root systems that help prevent soil erosion by stabilizing the soil. The leaf litter from these species decomposes rapidly, enriching the soil with organic matter and nutrients. Additionally, the deep roots of these trees can access nutrients deep within the soil profile, making them available to others plants<sup>12</sup>.

**4.1.3 Carbon reduction**

A pivotal focus of this program was to enable the sequestration of atmospheric carbon around the intervention area. The aim of this FDP in Uttarakhand was to sequester 30,00,000 Kgs of carbon annually through the plantations or 20kgs of carbon per tree per year. It must be noted that on average, trees can absorb between 10 – 40 kg of carbon per year<sup>13</sup> depending on multiple variables, including, size of the trees, root spread, type of soil, sunlight availability, water availability, plantation type, spacing of trees, root spread etc. Furthermore, trees only attain their carbon sequestration potential upon maturity. Most trees planted under this program will reach maturity in 12 – 15 years following their plantation, where on an average they may sequester 20 kgs of carbon per year.

***Ramgarh, Nainital***

Table 21 shows the carbon sequestration that could be achieved by these plantation efforts in Nainital from the observed survival of plantations by assuming average carbon potential of trees to be 20kg CO<sub>2</sub> sequestered per year.

<sup>12</sup> Risikesh Thakur: *Compacted soils: Characteristics, causes, management, and impact on crop*

<sup>13</sup> <https://ecotree.green/en/how-much-co2-does-a-tree-absorb>

**TABLE 21: CARBON SEQUESTRATION POTENTIAL PER PLANTATION IN NAINITAL DISTRICT**

Site	Proposed number of trees	Proposed carbon sequestration through plantation (kg CO <sub>2</sub> /year)	Survival rate	Estimated healthy trees	Estimated carbon sequestration (kg CO <sub>2</sub> /year)
Baribanj	10,000	2,00,000	90%	9,000	1,80,000
Nathuwakhan	42,000	8,40,000	95%	39,900	7,98,000
Satoli	3,500	70,000	96%	3,360	67,200
Kilour	20,000	4,00,000	95%	19,000	3,80,000
Bareth	25,000	5,00,000	95%	23,750	4,75,000
<b>Total</b>	<b>1,00,500</b>	<b>20,10,000</b>	<b>94%</b>	<b>94,671</b>	<b>18,93,420</b>

The projected carbon sequestration for the surveyed plantation sites was 2,010,000 kg CO<sub>2</sub>/year, while the estimated achievable carbon sequestration is calculated to be 1,893,420 kg CO<sub>2</sub>/year, representing 94% of the target. Extrapolating this rate of success to the remaining plantations in Nainital, they are expected to sequester approximately 2,820,000 kg CO<sub>2</sub>/year, compared to the proposed target of 3,000,000 kg CO<sub>2</sub>/year.

Noteworthy, the variety of tree species planted through this project have varying carbon sequestration potentials. In descending order of carbon potential, Padam, Banj, Baheda, silver oak and Kachnar have sequestration potentials higher than 20kg/ year, provided adequate spacing between trees to allow for optimal root and canopy spread, i.e., given proper maintenance of these plantations and regular replanting, the plantations can effectively achieve a carbon sequestration rate higher than the proposed target.

#### ***Naugaon, Uttarkashi***

The table below shows the carbon sequestration that could be achieved by these plantation efforts in Uttarkashi from the observed survival of plantations by assuming average carbon potential of trees to be 20kg CO<sub>2</sub> sequestered per year.

The projected carbon sequestration for the surveyed plantation sites was 10,00,000 kg CO<sub>2</sub>/year, while the

estimated achievable carbon sequestration is calculated to be 7,70,000 kg CO<sub>2</sub>/year, representing 77% of the target. Some of the tree species in Uttarkashi also have carbon sequestration potentials higher than 20 kg/year, given optimal conditions. These species include Deodhar, Kachnar and Reetha. This implies, that given regular watering and maintenance, the plantations could effectively reach or exceed the targeted carbon sequestration amount.

#### **4.1.4 Disaster risk mitigation**

##### ***Ramgarh, Nainital***

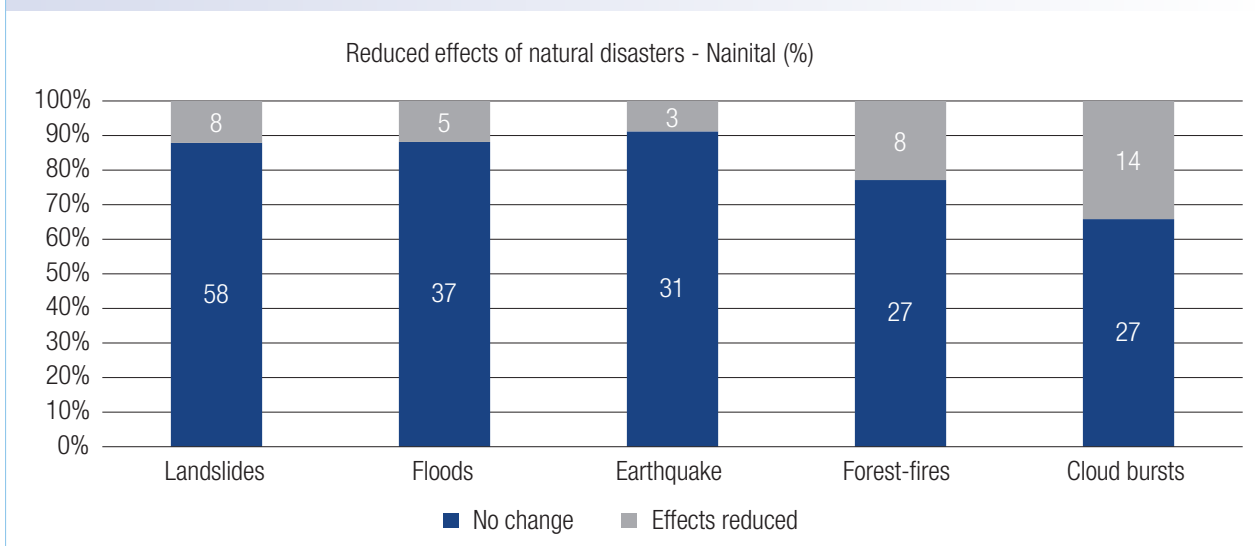
98% respondents stated that the Nainital region is prone to Natural Disasters, with the occurrence of Landslides as the most prominent hazard(35%), followed by cloudbursts leading to floods (30%). Forest fires is also a rising concern among the villagers.

When questioned as to the reduction in adversities posed by these disasters, 15% of respondents stated perceiving improvements while 85% noted that they have not noticed any improvements, suggesting that these changes will be noticeable once the trees start growing in height. The chart below represents the percentage of respondents who have noticed changes in effects associated with natural disasters.

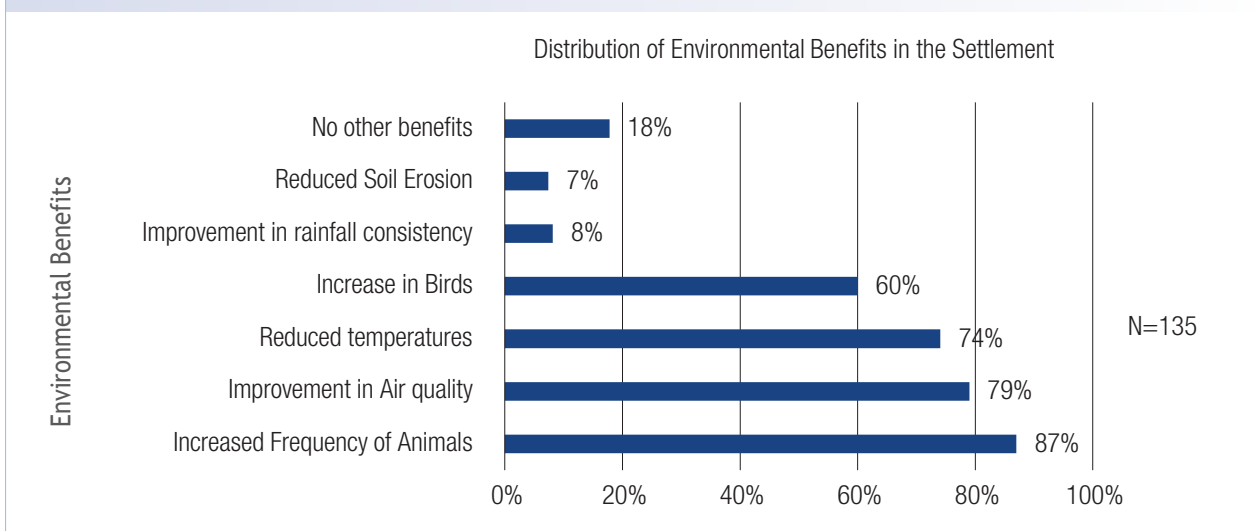
**TABLE 22: CARBON SEQUESTRATION POTENTIAL PER PLANTATION IN UTTARKASHI DISTRICT**

Site	Proposed number of trees	Proposed carbon sequestration through plantation (kg CO <sub>2</sub> /year)	Survival rate	Estimated healthy trees	Estimated carbon sequestration (kg CO <sub>2</sub> /year)
Lodan	25,000	5,00,000	84%	21,000	4,20,000
Sunara	25,000	5,00,000	70%	17,500	3,50,000
<b>Total</b>	<b>50,000</b>	<b>10,00,000</b>	<b>77%</b>	<b>38,500</b>	<b>7,70,000</b>

**FIGURE 23: REDUCED EFFECTS OF NATURAL DISASTERS**



**FIGURE 24: DISTRIBUTION OF ENVIRONMENTAL BENEFITS IN THE SETTLEMENT**



#### 4.1.5 Other environmental benefits

Apart from the above-mentioned environmental benefits, the afforestation effort also provided other ancillary environmental benefits. Respondents to the survey suggested noticing these improvements in and around the site area. Most significantly, community members noticed an increase in biodiversity in the site area, with 87% of respondents spotting local fauna and 60% observing more frequent bird sightings.

Furthermore, Improvement in air quality (79%) and reduced temperatures (74%) were also the perceived outcomes cited by respondents.

#### 4.2 Social and economic impact

The program has resulted in socio-economic benefits of in terms of livelihood enhancement and income generation.

#### 4.2.1 Employment generated

The program provided much needed employment to beneficiaries. The various processes in plantation generated employment opportunities for community members, leading to income generation for the period of plantation.

##### **Ramgarh, Nainital**

Field workers in Nainital were paid per sapling planted, at the rate of 8.5 per sapling. The average total income received throughout the project was Rs. 5,706 for women, and Rs.2,635 for men. This was the highest in Nathuwakan (Rs. 9,011) as it a much larger number of trees were planted and lowest in Kilor (Rs. 2,689) where the number of trees planted was lesser. Women beneficiaries received higher wages through the program as they were exclusively selected for nursery development, while also working on other activities within the program such as sapling transfer

and maintenance. Below is a table depicting the average earnings of each beneficiary through the project across the 5 intervention villages.

**TABLE 23: AVERAGE INCOME PER SELECTED VILLAGES IN NAINITAL DISTRICT**

Village	Average total Income
Baret	₹ 4,462.96
Baribanj	₹ 6,425.00
Kilor	₹ 2,689.66
Nathuwakan	₹ 9,011.90
Satoli	₹ 4,330.65

### ***Naugaon, Uttarkashi***

Field workers in Uttarkashi were paid per day of engagement. Male beneficiaries were paid Rs 500 per day while female beneficiaries were paid 400 per day. Through this, the average total income generated for beneficiaries was Rs 5,000 for women and Rs 10,000 for men across the duration of the program. While the income generated was definitely beneficial for community members, there was a large disparity between the income received of two gender groups. Further increasing this divide, payments were done in cash, which gave women little ability to secure their income. Additionally, predominantly male beneficiaries were selected to work on the plantation in Sunara.

### **4.2.2 Livelihood enhancement**

Apart from employment generation, these afforestation efforts also provided livelihood enhancement to direct beneficiaries of the project as well as community members through the economic benefits presented by the trees. An overwhelming 99% of respondents to the survey noted that most tree species planted in the project provided fodder for their domestic animals. Apart from this, a smaller percentage of around 10% of beneficiaries noted that agroforestry products such as aromatics can be gained from the tree species planted. Further, despite only 3% of respondents noting the medicinal benefits provided by these tree species, qualitative interactions highlighted that community members expected all trees species to provide medical benefits but were unaware of their values.

Below are some of the medical benefits of trees planted in Nainital and Uttarkashi:

**Amla:** The amla fruit has well documented medical benefits including boosting immune systems, restoration of vision and usage for diabetic patients.

**Banj:** Provides medical benefits in the form of anti-inflammatory and anti-bacterial properties.

**Kachnar and Kanol:** The bark, root and leaves of these trees have antimicrobial properties. Coupled with their usage in fodder, these trees provide immense benefit to domestic animals.

**Deodhar:** Several agroforestry benefits come from Deodhar trees. Chiefly, the inner bark of the tree produces a strong aroma that is used to make incense sticks. Additionally, oil can be made from fallen branches of the tree through steam distillation, which has several medical usages, primarily in treatment of ulcers.

### **4.2.3 Reduced wildlife conflict**

A primary concern noted by most respondents in the two districts was wildlife conflict. Mostly wild boars and monkeys (languor) which often disrupt their crops. Through qualitative interactions, community members noted that wildlife conflict had been steadily increasing over the years with reduction in forest habitat due to forest fires and deforestation. They noted that if plantations efforts such as this continue around their communities, wild animals would have little reason to disrupt their livelihoods.

### **4.2.4 Tourism**

Tourism is an important source of livelihood for communities in Uttarkashi. 100% of respondents in the survey noted the importance of tourism in their communities, either working in the sector or having a family member working in it. Similarly, 70.37% of respondents in Nainital also confirmed the importance of tourism to their economy. They noted that currently, there are not too many eco-tourism ventures that have opened up in the area, however, 82% of respondents from both districts noted that there is potential for the growth of the sector. When asked if they believed that these plantations could bolster eco-tourism, 32% of respondents replied positively. During qualitative interactions community members further highlighted that the number of such afforestation plantations needed to increase before it would affect tourism footfall.

## **4.3. Governance**

FDP set out to involve community in the plantation processes and their management. Thus, fostering community ownership and sustainability of the program.

### ***Ramgarh, Nainital***

Across the five locations, a strong community centric governance structure was implemented which led to effective community ownership and recall. In all the locations, involvement of local community members or relevant officials was ensured to understand the local context, soil texture, and need of the community. Relationships were built with PRI/van panchayat members and forest department officials to ensure a smooth dissemination of project activities. The project resulted in establishing governance structures where PRIs and van Panchayat are managing the plantations on their own. They have allocated resources for monitoring the plantation. This has been a perceptible change brought in by the project. These local governing bodies will also become responsible for distributing the benefits among the community members. Importantly, as mostly women were involved in these plantations, their increased participation will lead to higher representation in community led efforts going forward.

### ***Naugaon, Uttarkashi***

In contrast to the community-centric governance in Nainital, certain deficiencies were observed, in the plantation in Uttarkashi, particularly in Sunara. Inadequate capacity building for institutions like van panchayats led to a lack of community buy-in, thereby reducing the effectiveness of plantation efforts. Unlike other locations where governance structures were established, Sunara struggled to independently manage plantations. Insufficient resources allocated for monitoring and maintenance exacerbated these challenges, resulting in diminished project impact. Additionally, there was a missed opportunity to fully engage women in plantation efforts, which could have bolstered their representation and participation in community initiatives. By neglecting this aspect, the project failed to maximize community engagement and improve overall outcomes.

Despite this, the community engagement was much higher in Lodan. This was noticeable through the state of the plantation sites and their management of the plantations, even leading to the establishment of the 'Suraksha Samiti', who regularly monitors the site.



## Recommendations

The study findings demonstrated positive impact of FDP in the intervention areas and communities. To further enhance program impact in subsequent phases, following recommendations emerged.

### 5.1 Increase Focus on Community Awareness and Sensitization

The success of afforestation projects heavily relies on the active involvement and support of the local community. Therefore, it is crucial to intensify efforts aimed at raising awareness among community members about the importance of protecting forests and the significant benefits of plantation activities. This can be achieved through various channels, including community meetings, workshops, educational sessions, and the dissemination of informational materials. By effectively communicating the economic and environmental advantages of participating in afforestation initiatives, such as enhanced livelihood opportunities, improved ecosystem services, and mitigated climate change impacts, community members can be encouraged to actively engage in and contribute to the project.

### 5.2 Establish or Strengthen Community Institutions for Afforestation and Forest Management

Building upon successful community-led initiatives like the “Suraksha Samiti” in Lodan, there is a need to establish or strengthen similar institutions across project sites. These community-based organizations can serve as platforms for collective decision-making, resource management, and monitoring of afforestation activities. By empowering local institutions, such as van panchayats, through capacity-building workshops and training programs, communities can be equipped with the necessary knowledge and skills to

effectively manage and protect forest resources. Encouraging active participation and leadership roles for women within these institutions can also promote gender inclusivity and enhance the sustainability of project outcomes.

### 5.3 Implement Protection Measures for Plantations Through Fencing

To ensure the long-term success and survival of newly planted trees, it is essential to implement protective measures such as fencing around plantation sites. Fencing serves as a physical barrier to deter grazing animals, unauthorized entry, and other potential threats to the planted saplings. By investing in durable fencing materials and strategically securing plantation areas, the project can minimize the risks of damage and vandalism, thereby maximizing the growth and development of tree species. Additionally, involving local communities in the installation and maintenance of fencing infrastructure can foster a sense of ownership and responsibility towards protecting the plantations.

### 5.4 Enhance Record Keeping and Documentation Practices

Robust record-keeping and documentation practices are fundamental for effectively monitoring and evaluating the progress of afforestation projects. Establishing comprehensive systems for data collection, analysis, and reporting can provide valuable insights into project performance, challenges, and successes. Accurate documentation of plantation activities, including tree species planted, survival rates, maintenance efforts, and community engagement activities, is essential for ensuring transparency, accountability, and evidence-based decision-making. Regular monitoring and periodic assessments of project outcomes can help identify areas for improvement and inform adaptive management strategies to optimize project effectiveness and impact.

## 5.5 Enhance Donor Visibility

Recognizing and acknowledging the contributions of donors is essential for maintaining transparency, accountability, and trust within the project community. Implementing effective donor acknowledgment mechanisms, such as prominently displaying donor logos, issuing public acknowledgments, and including donor recognition in project communications and materials, can enhance donor visibility and

appreciation. By highlighting the vital role played by donors in supporting afforestation efforts, the project can strengthen donor relationships, attract continued funding support, and promote broader stakeholder engagement and collaboration. Additionally, fostering open communication channels with donors and providing regular updates on project progress and achievements can further enhance donor satisfaction and confidence in the project's impact and outcomes.



