MAHINDRA HARIYALI

IMPACT ASSESSMENT

FY 2020-2021

Mahindra

EXECUTIVE SUMMARY

This is the Impact Assessment report that highlights the impacts and outcomes generated by Project Hariyali by Mahindra Group in FY 2020-21, implemented by Naandi Foundation.

This report highlights the environmental indicators of performance of the project and also documents socio-economic benefits experienced by the beneficiaries in the Araku region.

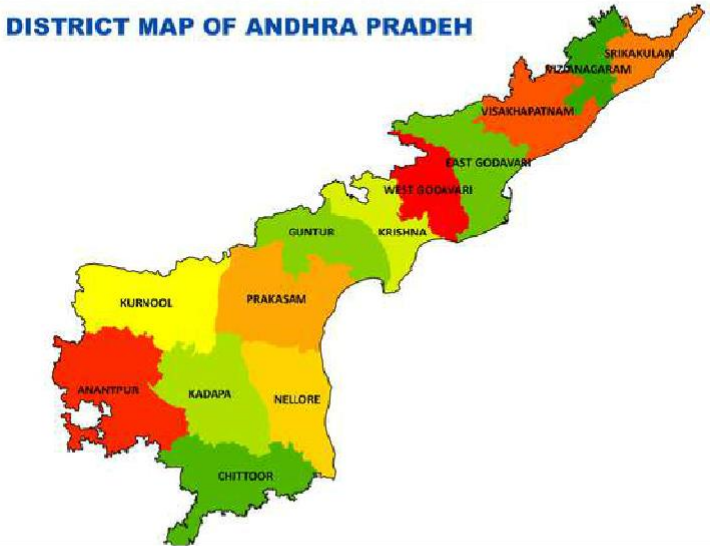
ABOUT PROJECT HARIYALI

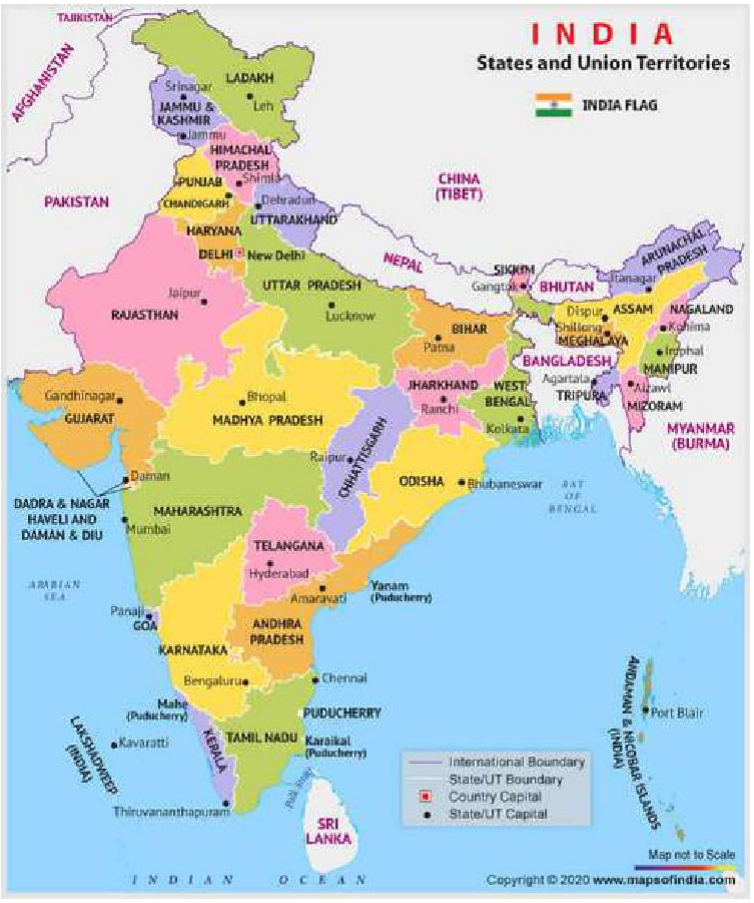
Project Hariyali is Mahindra's green initiative and CSR project initiated in 2007 and implemented since 2010. Through this program, Mahindra has committed to providing nature-based solutions to address issues related to climate change. Project Hariyali aims to plant 1 million trees annually which includes coffee plantations, fruit and shade trees in the region. Additionally, the project supports livelihood opportunities and encourages better socio-economic benefits in the Araku Valley.

LOCATION

This project was carried out in Araku Valley in Andhra Pradesh across 5 Mandals.
The Mandals are:

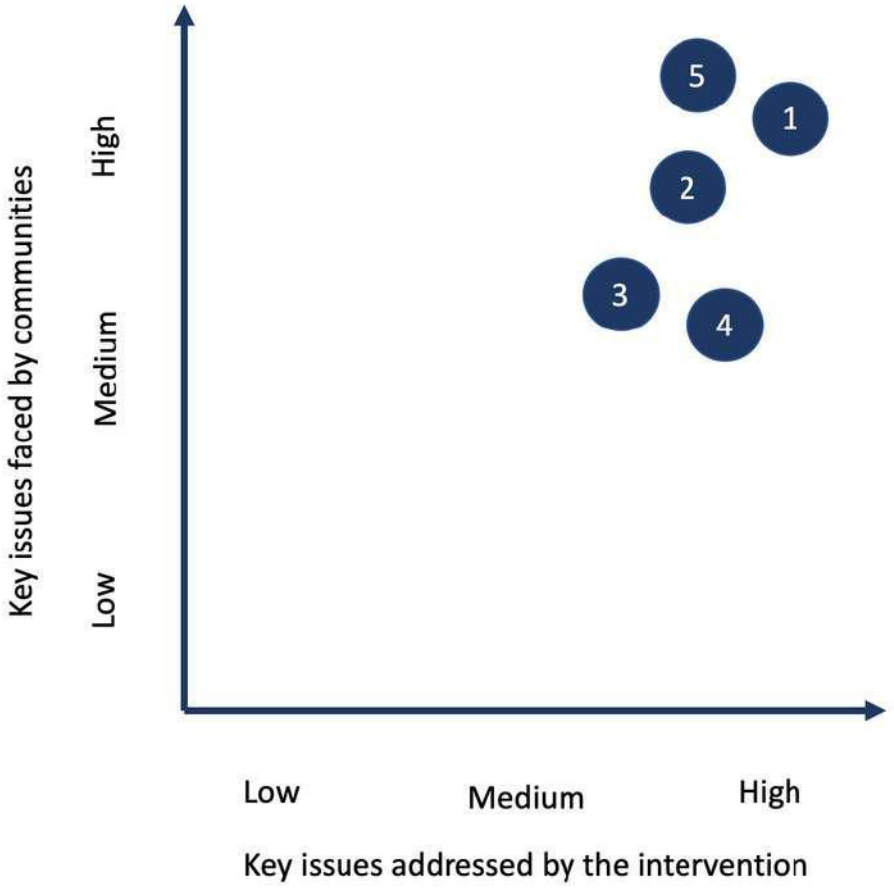
1. Anantagiri
2. Hukumpeta
3. Munchingput
4. Pedabayulu
5. Paderu





MATERIAL SOCIAL ISSUES

1. ***Low income levels***
2. ***Soil infertility***
3. ***Climate Change***
4. ***Biodiversity***
5. ***Farming Techniques*** & ***Knowledge Support***



IMPACT ASSESSMENT

Social impact is the consequences of the activities of an organisation on its stakeholders, as well as on society in general. Social impact results from the organisation's ability to anticipate needs that are not met and respond to them through prevention or compensation missions. This impact can be expressed in terms of individual wellbeing, behaviours, capabilities, social practices, social innovations or public decisions. Through this exercise, organisations are able to evidence the value their programs are generating and can gain deeper insight into what impact the programs have for their beneficiaries and stakeholders.

OBJECTIVES OF THE ASSESSMENT

- To assess the survival rate of the saplings planted during FY 2020-21
- To assess the carbon sequestration potential of the saplings planted during FY 2020-21 To
- document current and potential socio-economic benefits generated from the project

SCOPE OF STUDY

- Period of Assessment - FY 2020-21
- For the assessment, the Team visited 12 villages across 5 mandals.
- Number of beneficiaries of the project - **6,745 (farmers)**
- Number of saplings planted during FY 2020-21 - **9,00,257**

SUSTAINABLE DEVELOPMENT GOALS

ESTIMATIONS AND ASSUMPTIONS

1. STRATIFICATION

Stratum 1	Coffee (all 5 mandals)
Stratum 2	Jatropha, White teak, Erythrina lithosperma, Custard apple, Gliricedia (PDB and MPT)
Stratum 3	Lemon, Orange, Jamun, Amla, Almond, Mimusops elengi, Mahua, Mahogani, Arjuna, Annato, Shisham, Marsupium, Ramphal (PDB and MPT mandal)

2. SAMPLE DISTRIBUTION

STRATUM 1 - COFFEE

Mandal	Total Population	No.of samples	No. of plots	Survival rate	Population surviving
ANT	9,788	49	5	**95.6%**	9,357
HKP	150,042	122	11	**87.9%**	131,942
PDR	100,475	159	13	**86.9%**	87,290
PDB	92,388	49	10	**85.8%**	79,276
MPT	55,732	44	9	**74.8%**	41,695

STRATUM 2 - MAJOR SPECIES

Mandal	Total Population	No.of samples	No. of plots	Survival rate	Population surviving
PDB	9,862	109	10	**78.8%**	7,766
MPT	294,988	109	9	**84.6%**	249,640

STRATUM 3 - OTHER SPECIES

Mandal	Total Population	No.of samples	No. of plots	Survival rate	Population surviving
PDB	6,248	153	10	**78.8%**	4,920
MPT	180,734	137	9	**84.6%**	152,950

3. BIOMASS AND CO2 E EMISSION REDUCTION

Stratum	Average Biomass per sapling (kg)	Total Biomass (tonne)	Average Biomass per sapling after Uncertainty deduction (kg)	C stock in Shrub biomass without uncertainty discount reduction (t CO2e)	C stock in Shrub biomass with uncertainty reduction (t CO2e)
1	0.2699 0.491 0.7155 0.3699 0.1606	2.525 64.775 62.453 29.325 6.695	0.4684		
2	1.930 3.352	14.989 836.857	3.306	**2,058.573**	**1,457.692**
3	1.015 1.124	4.993 171.916	1.120		

ASSUMPTIONS MADE FOR BIOMASS AND CARBON EMISSION REDUCTIONS CALCULATION

1.Since the growth of most species was similar, a general equation is used. Some samples of a few species like Gliricidia grew up to a height >130cm, but had no defined crown cover. Moreover, such species usually tend to be grafted – accounting for the height. Thus, such outliers were ignored, and a common equation was used to estimate biomass.

2.The stratifications, that would otherwise be possible based on altitude, soil depth, soil composition, shade, DBH range is ignored in this case because of its small size attributable to its age.

3.The plantation population was stratified into: Stratum1 - Coffee, Stratum2 - Major species (Custard apple, Gliricidia, White teak, Jatropha, Erythrina lithosperma) and Stratum3 - Other species.

4.Conservatively, Survival rate was applied to the population in each mandal, in each of the above-mentioned strata. This is because the difference in survival rate per mandal was highly distinguishable.

5.Most species fall under the category of a small tree or shrub, including coffee. Thus, the following equation is chosen:

$$\exp(-2.281 + 1.525 \ln(BD) + 0.831 \ln(CD) + 0.523 \ln(H))$$

a. The allometric equation is chosen conservatively. Most equations available globally address trees with DBH>5cm and 10cm. Only one equation made available by FAO, addressed trees with DBH>3cm. None of these fit best in our project scenario, because of its small size, weight and age.

b. Thus, the above equation was finalized, which is reported to be a significant shrub model, for trees with AGB >10kg.

Since, most project plantations were below 10kg, the estimated relative error of +33% by the paper (equation) was reduced from our estimated above ground biomass from each sample, to address the uncertainty.

c. Further, a default ratio of 0.4 provided by the AR-AMTool 14 was used to determine the below ground biomass (BGB). This, along with the AGB was used to determine the total biomass of each sample.

The values obtained using allometric equations for sample size is then extrapolated to the entire population with an appropriate reduction of mortality rate.
This biomass was used to calculate the C stock and corresponding CO2 equivalent emission reduction, applying the default carbon fraction and root-shoot ratio provided in AR-AMTool 14.

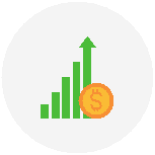
Weighted average was used to estimate uncertainty and suitable deductions to the biomass were thus made resulting in 1,457.692 tCO2e. emission reduction as C stock from 900,257 saplings.

OUTCOMES

Although the main focus of this report is the impact assessment of the survival rates of the saplings and carbon sequestration potential, during our visit, we also noted socio-economic benefits generated by the project.

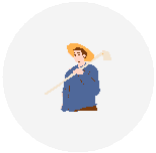
Soil Fertility & Nutrient level

During discussions with farmers, they explained that organic inputs (bio-fertilisers such as W-100,C-100) and soil management techniques provided by Project Hariyali helped them achieve increased yield for their crops and help improve soil fertility. It was observed that the soil colour visibly deepened, indicating the presence of higher moisture content.



Diversification of Farmer's income

By planting diverse saplings fruits and coffee along with other cash crops, multiple income sources were created thereby uplifting the farmers' livelihoods. Although, at present the saplings are nascent, farmers can see income benefits in the foreseeable future once the saplings grow and bear fruit and shade.



Supporting Livelihood

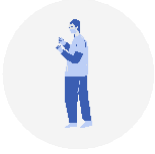
Farmers are supported in not only growing their produce effectively to achieve greater crop yield, but also in finding a platform to sell their produce for a good price. Farmers sold their produce through the Small and Marginal Tribal Farmers Mutually Aided Cooperative Society.

Increased Biodiversity

Multiple varities of saplings were provided to farmers - ranging from coffee and fruits to tree varieties that offer shade. This variety promotes biodiversity within their plots, thereby enhancing the eco-system.

Increase Green-Cover

Plantation activity helps improve green-cover in the region.



Technical Support & Knowledge Sharing

Naandi Foundation’s expert team provides farmers with the technical know-how and training on various soil and sapling management techniques. Additionally, farmers also receive organic inputs such as C-100, W-100 and a diverse range of saplings which helps increase their yield and manage their crops better.