



# Mid Term Review Report

Monitoring & Evaluation (M&E) for Project on  
Climate Resilient Agriculture (PoCRA) in  
Marathwada Region, Maharashtra



Nanaji Deshmukh Krishi Sanjivani Prakalp (Project of Government of  
Maharashtra in Partnership with the World Bank)

Submitted By



In Association With



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## Key Abbreviations

AA	Agriculture Assistant
APMC	Agricultural Produce Market Committee
ATMA	Agriculture Technology Management Agency
BBF	Broad Bed Furrow
BPL	Below Poverty Line
CA	Cluster Assistant
CCT	Continuous Contour Trench
CHC	Custom Hiring Centre
CRAT	Climate Resilient Agriculture Technology
DBT	Direct Beneficiary Transfer
DoA	Department of Agriculture
DPA	Drought Prone Area
FGD	Focus Group Discussion
FIG	Farmer Interest Group
FFS	Farmer Field School
FPO/ FPC	Farmer Producer Organization/ Farmer Producer Company
GHG	Green House Gas
GIS	Geographic Information System
GKVS	Gram Krishi Vikas Samiti
GoM	Government of Maharashtra
HH	Household
IDI	In-Depth Interview
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
INM	Integrated Nutrient Management
MIS	Management Information System
NRM	Natural Resource Management
PAD	Project Appraisal Document
PDO	Project Development Objective
PMU	Project Management Unit
PoCRA	Project on Climate Resilient Agriculture
PS	Project Specialist
RFID	Results Framework Indicators
SDAO	Sub-divisional Agriculture Officer
SHG	Self Help Group
TAO	Taluka Agriculture Officer
VCRMC	Village Climate Resilient Management Committee
WB	World Bank

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## Executive Summary

Project on Climate Resilient Agriculture (PoCRA) is being implemented by the Maharashtra government in collaboration with the World Bank to enhance climate resilience and profitability of smallholder farming systems in selected districts of Maharashtra. The project is built around a comprehensive, multi-sector approach that focuses specifically on building climate resilience in agriculture through scaling up tested technologies and practices. Sambodhi, in partnership with TERI, has been recruited for conducting M&E of PoCRA in all eight districts of the Marathwada region.

As part of the evaluation, a baseline, midterm review (MTR), and end-term evaluation were planned to be conducted. The baseline survey was the first step and a key component of the impact evaluation of the PoCRA project in the Marathwada region, which was undertaken in 2019. The midterm survey has been conducted in Year 3. The end-term evaluation is planned for 2024 towards the end of the project.

The overall objective of the midterm review was to assess the extent of targets achieved, examine the determinants for enabling and disabling the achievement of targets, assess the extent of awareness within the community, capture key learnings from the implementation experience, and recommend doable actions for the remaining project period. The midterm review report uses comparisons to baseline data and assesses the impact by measuring key indicators at the mid-term stage of the project. It adopts the same methodology employed at baseline to ensure comparability of data and results. The midterm review assesses the current situation on relevant variables mentioned in the results framework and on key Environment and social management framework (ESMF) related indicators.

In line with the methodology mentioned in the inception report, a quasi-experimental design with a double difference method is being adopted for impact evaluation. The estimated sample size (number of households or respondents) that were targeted to be covered in project and comparison area was 2410 each, i.e., a total sample of 4820. This proposed sample size is powered to have an MDI (minimal detectable impact) of 5 %.

A multi-stage sampling distribution is adopted for this evaluation. For the midterm review, a representative sample is taken across all eight districts in Marathwada, from which 482 clusters (equally distributed in project and comparison) have been selected. Further, two villages were randomly selected from each cluster, and five households were selected from each village using systematic interval sampling. Along with the quantitative survey, qualitative interviews which include FGDs with different categories of potential beneficiaries (landless, farmers with landholding less than 5 acres and farmers with landholding more than 5 acres), SHG members, FIG representatives and IDIs with Gram Panchayat representatives and FPC/FPO representatives along with field observation visits by key experts and research team members were conducted to understand the challenges faced by the potential beneficiaries and the bottlenecks in the execution of the project. Complete sample coverage has been achieved as the sample of 4820 has been covered.

## Key Findings

As the area targeted by PoCRA is rainfall dependent and drought-prone area, irrigation plays a crucial role in agricultural production. To know the access to irrigation, the farmers were enquired if they have any source of irrigation for the land they cultivate. In the midterm review, approximately 78% of farmers in the project and 59% of farmers in comparison areas informed that they have access to irrigation sources for their land. It is higher than the percentage of farmers who reported the same in baseline, which was 49% in project and 47% in comparison areas.

With those farmers having a source of irrigation for their land, it was further enquired if they are able to get water from their source when they require it for irrigation. Around two-third (2/3<sup>rd</sup>) of respondents in both project (70%) and control (64%) reported that they can always get water from irrigation whenever they require it. When compared with the baseline situation, there is a good improvement in the reliability of irrigation facilities in both project and comparison areas. In baseline, only about 9% of respondents from the project and 10% of respondents from the comparison acknowledged that water was always available from the source when they required it.

When asked to the respondents if they had any land under orchards or plantations, only 7% of respondents from the project area and 3% of respondents from the comparison area reported having so. More than one third of farmers (Project: 42%; Comparison: 40%) reported of growing trees on the periphery of their agricultural lands. The most widely grown tree is neem, followed by mango and babul, ber and tamarind.

The midterm review also aimed to enquire about the extent to which the protected farming practices like shade-net, poly house, or polytunnel were adopted. From the sample of surveyed farmers, about 22 farmers (as compared to 8 in the baseline) reported using shade-net in the project area, whereas none from the comparison area reported using shade-net. Similarly, while five farmers (as compared to one in the baseline) reported using the poly house for cultivation, none in the comparison areas used poly house. One farmer reported using a polytunnel in the project area. This shows that though the farmers in project areas have started adopting the protected farming technologies, its penetration is still very low in the Marathwada region in both project and comparison areas.

PoCRA, through its intervention, also aims to improve the cropping intensity in the project area. Cropping intensity is defined as gross cropped area divided by net sown area multiplied by hundred. The cropping intensity in the project area is 153 percent (as compared to 112 percent during baseline), and that in the comparison area is 149 percent (as compared to 114 percent during baseline). The DID (difference in the differences between project and comparison) estimate for the cropping intensity is 6 percent.

As part of the midterm review, the farmers were asked about the crops they had grown on their land during different agriculture seasons in the last one year. It was found that soybean (project: 45%, comparison:46%) and cotton (project: 29%, comparison: 28%) are the most widely grown crops in the Kharif season. These are followed by Pigeon-pea, Maize, Black gram, Green gram, and Millets.

In the Rabi season, the most widely grown crops were found to be Chickpea (Project: 46.5%, Comparison: 48%), followed by Sorghum-Rabi (Project: 21.5%, Comparison: 21.5%) and Wheat (Project: 21.3%, Comparison: 22%). Crop-wise percentage of land cultivated using irrigation for both Kharif and Rabi seasons was also analyzed. In Kharif crops, it was found that the highest percent of irrigated land is for turmeric (96.4%), black gram (63.9%), and sugarcane (62.5%) in the project area. These were followed by cotton (55%), Sorghum (54.6%), Pigeon peas (53.8%), and Soybean (47.3%). For Kharif crops in comparison area, a similar trend was observed, with Turmeric having the highest area under irrigation (84%), followed by Sugarcane (78.6%), Maize (49%), Green gram, Pigeon pea, Cotton and Soybean.

During the cultivation of rabi crops, the percentage of land under irrigated land is higher. Percent of cultivated land under both chickpea and sorghum being irrigated is higher (Project:88%, Comparison:71%). As part of the midterm review, the response of farmers on the availability of machines/tools on the rent was enquired. It was observed that a reasonably high (Project: 75% and Comparison:74%) percentage of farmers were able to use/rent farm machinery when required. When asked about the availability of agriculture-related skilled labour in their area, 73.5% from the project area and 71.4% from the comparison area said that skilled labour was available for work when they needed them.

The midterm review team asked the farmers on pest management in their fields; and their practices and awareness related to pest management. The survey team asked the farmers if they prepared these solutions on their farms. It was found that only 5.5% of the farmers in the project and 6.1% in comparison villages have reported that they prepare Jeevamrut/ Beejamrut/ Neem extract solution for application on their land.

The survey team enquired the farmers about the awareness of the different natural enemies to pests. However, the findings revealed that awareness was low with most responses for the spider, parasitic wasp, and dragonfly. Nearly 50 % of respondents in both project and comparison areas were not aware of any natural enemies to the pests. Besides natural remedies, the farmers were asked about their use of pesticides. About 81% of farmers in the project and 84% in the comparison area acknowledged using pesticides in their fields. The farmers who acknowledged using pesticides were further enquired about the safety measures they adopt while spraying pesticides on the field. The most common safety measures adopted by the farmers are to cover their eyes and nose while spraying (Project = 78%, Comparison = 79%), wear gloves while spraying (Project = 70%, Comparison = 71%), and take a bath after spraying pesticides in the field (Project = 88%, Comparison = 87%).

As compared to baseline observations, the percentage of farmers who reported disposing of the pesticide bottle safely after use has improved. The multiple methods adopted for disposal of pesticides containers include triple rinse container (Project = 46%, Comparison = 47%), puncture /collection for safe disposal (Project = 59%, Comparison = 61%), and did not reuse (Project = 81%, Comparison = 80%).

The farmers were asked if their crop was affected by any pest or disease in the last 12 months. As compared to the baseline observations, the percentage of farmers affected by pests has reduced in the midterm. It is observed that 64% (as compared to 84% in the baseline) farmers in the project area and 65% (as compared to 89% in the baseline) farmers in the comparison area reported of their crop being affected by pests or diseases in the last 12 months.

The farmers who said that they had been affected by pests and diseases were further asked to specify the crops which were affected by pests and diseases. The crops most affected by pests and diseases are soybean (Project: 41%; Comparison: 41 %), cotton (Project: 37%; Comparison: 41%) and Pigeon pea (Project: 12%; Comparison: 12%). Nearly 73% of farmers in both project and comparison were aware that the pesticides they are using as a measure to control pests were not banned or restricted for use.

The awareness of soil testing was found to have improved since the baseline survey but remains low, with only 33% (as compared to 28% in the baseline) from the project and 30% (as compared to 25% in the baseline) from comparison saying they had knowledge about it. Of the respondents who were aware of soil testing, 93% in the project and 96% in comparison areas had never undertaken soil testing of their fields. Out of the respondents aware of soil testing, 5% in project areas and 3 % in comparison areas reported getting soil testing done but did not have their cards available with them. Only 2% of respondents in the project and 1% of respondents in comparison areas acknowledged getting soil testing done and having their soil health card available.

The practice of intercropping is not widespread. Only 8% in the project area and 11% in the comparison area reported that they have ever practiced it. The most popular combination of crops for intercropping is Soybean and Pigeon pea (Project: 49%; Comparison: 52%), followed by Cotton and Pigeon pea (Project: 37%; Comparison: 26%).

The midterm review team also asked the farmers how they deal with the crop residue after harvesting the crops. The most common method followed is burning in the field (Project: 68%; Comparison: 67%), followed by using it as animal feed (Project: 44%; Comparison: 46%). Only 9% of farmers in the project and 7% in comparison areas use the remaining stubble as mulching for their fields.

One of the key interventions of the PoCRA has been Farmers Field School (FFS). During midterm, the expert team also assessed the changes brought through the FFS. It was found during an expert field visit that the critical thinking, experimentation, and innovation skills of fellow farmers have improved. The farmers started questioning previous assumptions or cultural beliefs and reflected critically on the results of their own observations and experimentation. For example, the farmers placed greater reliance on their empirical field observations of crop performance than on following the advice of village elders. It was also found that the farmers are changing their attitude towards conserving water and soil. The FFS helped farmers to gain confidence in their farming activities. They became more motivated and proactive in their planning.

During the midterm review, the survey team asked the farmers how they sell their harvest (all sources where they sell their produce). It was observed that 49% of the farmers in both project and comparison areas reported selling their produce directly in the haat or via retail mode. It is to be noted that only 22 % of the farmers in the project area and 19 % in the comparison area reported selling their produce in the nearest APMC mandi/market. The survey team also asked the farmers how they transported the produce to the market in case they did not have it picked up from home. It was observed that farmers mostly use commercial vehicles such as pick-up trucks for transporting their produce to the market (32% in both Project and Comparison). This was followed by the use of the light vehicle (Project:25 %, Comparison: 27%) and tractors (Project:35 %, Comparison: 33%). The average distance traveled to sell produce is 31 kilometres for the farmers in the project area and 27 kilometres for the farmers in comparison areas.

It was observed that only 22% of the farmers in the project and 21% in comparison areas knew about pledge loans. Of the farmers who were aware of the pledge loan, the survey team asked if they had availed this scheme. It was observed that only 19% from project and 26% from comparison areas had done so. Though the percentage of farmers in both project and comparison areas, the biggest reason for not availing of pledge loan was that the farmers felt they did not require it.

Only 5 % of the farmers in the project and 3% in the comparison area acknowledged having access to the cold storage facility. Lack of access to grading and sorting facilities in the Marathwada region was observed as only 4% of farmers in the project, and 3% of farmers in the comparison area reported of having access to grading and sorting facility.

The respondents across project and comparison areas were asked if they were involved in allied activities like dairy, honey, wool, etc. Overall, it was found that 16% of respondents across the project and 14% of respondents across the comparison were engaged in the dairy activity. About 11% of respondents in the project area and 9% of respondents in the comparison area reported being engaged in rearing livestock. The uptake of other agri-allied activities is almost negligible in the project area.

The respondents were also enquired about their non-farm income from different sources. Agriculture labour, business, and remittance are the three prominent non-farm sources of income for the respondents apart from their income from agriculture. As part of the midterm review, the current adoption rates of different climate resilient agriculture technologies were assessed. The technologies related to preparation and cultivation, such as using improved seed varieties, land preparation, use of machinery, and intercropping, showed better adoption than others. The adoption trends were observed to be similar across both project and comparison areas.

As the objective of the PoCRA is to reduce the climate vulnerability of its target beneficiaries, the respondents were asked if they faced any climate vulnerability, like less rainfall, high temperature, dry spell, and unseasonal rainfall in the last one year. The climatic shocks affect not just the farmers but every person's livelihood. Nearly 54% (which has reduced by about 19% since baseline) of respondents across the study area reported that they had been affected by climate vulnerability in the past one year. It is observed that drought (Project: 28%; Comparison: 26%), flood (Project: 41%; Comparison: 40%), untimely rains (Project: 52%; Comparison: 51%), extreme temperature (Project: 28%; comparison: 25%), pest attacks (Project: 45%; comparison: 47%) and crop diseases (Project: 50%; comparison: 52%) were key climatic vulnerabilities experienced by most by the farmers in our study area. The respondents who were practicing farming and who claimed to have experienced any climatic shock were then asked about the technology adopted by them to deal with the climate shocks. The perceived technology reported to be the most helpful to tackle climatic shock was found to be the use of improved/climate-resilient seed varieties (Project: 59%; Comparison: 62%).

Almost all the VCRM's mentioned that the socially vulnerable groups are taking the benefits of the project without any discrimination. Out of the 16 VCRM's interviewed, 9 VCRM's reported that they have NRM works in the villages. According to the VCRM members, the perceived benefits were the increase in water availability as well as an increase in soil moisture. The VCRM members also reported that there has been an increase in awareness amongst the farmers for the use of technology in farming through farmer field school. It is observed that the administrative composition of VCRM members is according to the GR, which mandates that out of 13 members, at least nine members should represent the marginal/small/landless category (under Form 8 A land holding category) possess less than 2 ha. land. The VCRM members said that there was need for capacity building of the members of the VCRM for the better implementation of the project. It is pertinent to mention that many VCRM members have been changed in many Gram Panchayats after

baseline survey of PoCRA project in 2019 after the Panchayat election in 2021. Therefore, capacity building of newly joined VCMRC members after the recent Panchayat election should be prioritized. The capacity-building training demanded by the VCRM members was related to administrative and financial matters as well as different aspects of agricultural practices and marketing. Some VCRM members also demanded that the training on Microplanning and the NRM work is necessary for them.

Out of the 16 Krushi Tai's seven have reported that they have undergone training at some point in time since the joining. The training was mainly related to learning roles and responsibilities, project components such as drip and sprinklers, micro-irrigation systems. KT's were aware of the beneficiary prioritization in the DBT application, and the work of mobilization was done in the form of doorstep visits to the potential stake holder as well as conducting and arranging the meetings for the villagers.

To understand the penetration of digital platforms (mobile and web use) related to agriculture, the respondents were asked if they used mobile applications and online websites related to agriculture after project implementation (June 2018). Approximately 13% (a marginal increase of 2% since baseline) of the respondents in the project and 11% in comparison areas used mobile applications or websites to access agriculture-related information. When further enquired about the type of digital solution used, it was found that the applications and websites mainly used by the respondents are mKisan, MSAMB app, and Krushi King. mKisan was used the most, with 54% of respondents in project areas and 61% of respondents in comparison areas informed that they used this application.

The survey team also enquired about other technological sources of information used by the respondents for information on agriculture after project initiation (June 2018). It was found that the Television (Project: 64%; Comparison: 64%), E-Seva (Project: 29%; Comparison: 24%), Newspaper (Project: 26%; Comparison: 23%) and SMS on phones (Project: 26%; Comparison: 24%) seemed to be the frequently used sources of information.

Apart from their own use of sources of information on agriculture, the respondents were also asked if they received advisories on climate or agriculture after project initiation (in June 2018). It was observed that an equal proportion of respondents (nearly 92%) from project and comparison areas had received such advisories compared to those who did not receive them.

For those who said they had received advisory on climate and agriculture, the survey team further asked about the type of advisory they received. Majority of respondents had received advisory on crop pricing (Project: 73%; Comparison: 68%) followed by pests and diseases (Project: 45%; Comparison: 45%), weather forecast (Project: 70%; Comparison: 69%) and crop planning (Project: 54%; Comparison: 44%).

Small and marginal farmers (62% of total 7958 members) dominate the membership in 24 FPCs surveyed. Support for FPCs has led to an increase in agribusiness activities which has, in turn, led to the generation of employment. In the past 12 months, nearly 884 persons have been provided employment in FPCs which includes nearly 25% of women. The average annual turnover of 16 FPCs increased by 16% from 2018-19 to 2019-20 and 60% from 2019-20 to 2020-2021. The FPCs also recorded profits. In 2020-21, the average profits increased by nearly 50%.

Based on findings of MTR, the key recommendations are summarized below.

- **Packaging of Climate Resilient Agriculture Technologies:** As the climate resilient technologies have multiplier effect when implemented together, it is recommended to package them in categories<sup>1</sup> that enhance water security at farm level (including rainwater harvesting, BBF, contour cultivation and micro irrigation), improve soil health (including conservation tillage, mulching and green manuring), and improve farm productivity and income (including use of climate resilient seed varieties, INM, IPM, intercropping and agroforestry), and encourage the farmers to adopt these technologies together. Suitable IEC materials should be developed for the farmers, highlighting the multiplier effects and cumulative benefits when group of technologies are implemented together. The farmers should be persuaded that the selected technologies, when implemented together result in a more productive and efficient use of resources, which increase water availability and overall farm production while reducing the risks associated with intra- and inter seasonal climate variability.

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<sup>1</sup> Adapted from PAD Triple Win Solution at page 20

- **Selection of Crops:** Based on the assessment of crops on the criteria of cost of production (using C2plus50 formula of MS Swaminathan Committee), water productivity, and availability of climate resilient varieties, it is recommended to promote pulses (Black gram, Green gram, Pigeon pea and Chickpea) together with Soybean in the project area, while discouraging the farmers to grow Cotton. Soybean cultivation should be promoted selectively while assessing the market demand and supply in different years. It is also recommended to promote these crops in inter-cropping and agroforestry system. As inter-crops, these crops can be grown together with vegetables (like Chilli, Onion, Okra, Capsicum) where water is available or with medicinal and aromatic plants like Turmeric and Ginger. In agroforestry, these crops can be grown together with Papaya, Guava, Custard Apple and Citrus. The recommendations for promoting pulses and those crops which require less water are in line with the Govt of Maharashtra, and Government of India strategy to encourage farmers shift to larger area under these crops and adopt best technologies and farm practices, to correct demand - supply imbalance in pulses<sup>2</sup>.
- **Agro-meteorological Advisory Service:** It is recommended to provide location and time-specific agrometeorological advisories to the farmers. The meteorological advisory will include collecting, processing, and managing agro-meteorological data. The agro-advisory services will include crop specific package of practice, and technical advice on water management practices during drought, and on diseases and pest management which will aim at enhancing local capacity for community-level pest and disease surveillance. The agro-advisory services will be SMS/WhatsApp/Mobile App and phone-in help system, where farmers can call and seek advice. The approach will help farmers in reducing climate risks and enhancing crop productivity. Based on this integrated advisory support, the farmers can plan their agricultural activities by adapting to changing climatic conditions. It is recommended that the project work closely with agricultural universities and Indian Meteorological Department (IMD), to develop suitable IEC materials/ mobile apps to communicate with the farmers on agro meteorological information.
- **Emphasize Community NRM Work:** Community NRM works under PoCRA were found to be implemented in limited numbers. Along with the individual benefits, community interventions for increasing the ground water level should be implemented to maintain the water balance. Micro planning and community works should be planned on a priority basis. Along with them, renovation/ rejuvenation of old dysfunctional NRM structures should be promoted to maintain the water balance.
- **Build Further Capacity of VCRM Members:** Refresher training and regular capacity-building support should be provided to the VCRMCs to ensure that they are able to fulfill their roles and responsibilities. Regular monitoring and handholding support should be provided to improve record management within the VCRM.
- **Provide Handholding Support to FPOs/FPCs:** Orientation and training on the value addition of produce, their storage, transportation, and marketing should be provided to the FPO/FPC members. Handholding support should be provided to the FPOs/FPCs to develop a bankable business plan so that banks would be ready to provide them with loans. Support from professionals of civil engineering backgrounds should be engaged for technical verification of civil works such as a warehouse.
- **Promote Financial Linkages:** PoCRA should develop -ups with financial institutions to provide loans to the beneficiaries based on the received pre-sanction. Ways should be explored by which the applicants having pre-sanction are provided partial disbursement or vouchers through which they can purchase assets from empaneled suppliers.
- **Capacitate Farmers' Field School:** More focus needs to be given in mobilizing farmers to attend FFS sessions. Exposure visits to progressive farmer's plots act as a motivator for farmers to act as host farmers. Timely payment of honorarium or conveying the status of honorarium can help in keeping the rapport of the FFS and its host farmers positive amongst the farmers. More focus needs to be given to the capacity building of FFS facilitators.
- **Empower Krishi Tai:** Krishi Tai's perceptions regarding the project and their roles and responsibilities varied in different areas. In many places, they were not effective, either because they were not getting the honorarium on time, or they found the honorarium to be very low. To keep them motivated, it should be ensured that they get their honorarium on time. The refresher training needs to be conducted for Krushi Tais so that they get clarity on the project and their roles and responsibilities. Better coordination between CAs/AAs with Krushi Tai can help in both supporting each other in their role.

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<sup>2</sup> <https://pib.gov.in/PressReleasePage.aspx?PRID=1725612>

- **Enhance Compliance with Environmental Safeguards:** It is recommended to conduct separate orientation and training on environmental safeguard and their compliance. Environment compliance mechanisms should also be put in place. Different ways of promoting environment-friendly interventions like organic farming, controlled grazing, plantation, etc., should also be promoted.
- **Promote Initiatives for Sustainability of Project Interventions:** The sustainability of project interventions is a crucial issue in PoCRA. The field experience indicates that the farming communities are more concerned about the economic return than environmental concerns. Therefore, it is recommended that the project staff should start emphasizing and sensitizing the local communities about the project sustainability, and intervention strategies should be reviewed from the sustainability angle of the project interventions.

## 1. Introduction

Agriculture being the primary source of livelihood in the State, Maharashtra has 22.6 million hectares of land under cultivation (gross cropped area) and 5.21 million hectares under forest. About 84% of the total area under agriculture in the state is rainfed and is dependent only on monsoon<sup>3</sup>. About 49% of the landholdings in the state fall in the marginal category, with less than one hectare (1 ha) of land. Most of these farmers with small and unirrigated land holdings are vulnerable to climate risks. Moving these farmers out of the current crisis of high production cost, low profitability due to low productivity, and lack of market access is one of the biggest challenges for the state. Also, the critical issues related to water scarcity, degraded land, increased cost of cultivation, and the impacts of climate change need to be addressed to reduce the vulnerability and improve the profitability of the smallholder farmers. To respond to the above-mentioned challenges, the Government of Maharashtra, in partnership with the World Bank, conceptualized the Project on Climate Resilient Agriculture (PoCRA). This project attempts to bring transformational changes in the agriculture sector by scaling-up climate-smart technologies and practices at farm and (micro) watershed levels, that would contribute to drought-proofing and management of lands in states' most drought and salinity/sodicity-affected villages. The project focuses on small landholders especially those from vulnerable populations whose livelihood is impacted by changing climate conditions and climatic uncertainties.

### 1.1. Overview of the Study Area

The project has been implemented in 347 mini watershed clusters covering 5142 villages in 15 districts of Maharashtra, which include eight districts of Marathwada (Aurangabad, Nanded, Latur, Parbhani, Jalna, Beed, Hingoli, Osmanabad), six districts of Vidarbha (Akola, Amravati, Buldana, Yavatmal, Washim, Wardha), Jalgaon district of Nashik Division and approximately 932 salinity affected villages in the basin of Purna river spread across Akola, Amravati, Buldana, and Jalgaon districts<sup>4</sup>. Figure 1 highlights the villages where the project is implemented. This project is being implemented over a period of 6 years, from 2018 to 2024. The implementation is in a phased manner reaching out to 70 clusters in the first year, 175 clusters in 2<sup>nd</sup> year, and 102 clusters in 3<sup>rd</sup> year.

#### Marathwada Region

An overview of the demographic and agro-ecological attributes of this region while contextualizing the broader discourse of resilience is necessary. About 40% of Maharashtra falls under the Drought Prone Area (DPA), with less than 750 mm of annual average rainfall<sup>5</sup>. In Maharashtra, the Marathwada region specifically has been floundering under drought conditions since 2012, with the highest rainfall deficit in the country at 48% in 2014. Marathwada region coincides with Aurangabad Division and consists of eight districts, namely, Aurangabad, Beed, Latur, Osmanabad, Parbhani, Jalna, Nanded, and Hingoli. The region has a population of about 1.87 Crores and a geographical area of 64.5000 sq. km. Agriculture is the major source of income generation for over 64% of the state's population. However, given harsh weather conditions, the region's agricultural system has been depleting significantly. Jowar and Bajra, along with other Kharif crops, were completely wiped out in 2012 when the monsoon failed (Kumar, 2013). Jalna district, famous for being the biggest producer of sweet lime, had been the worst hit by the drought. Two important cash crops in

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<sup>3</sup> Source: PoCRA Project Implementation Plan (PIP) document

<sup>4</sup> Source: Terms of Reference

<sup>5</sup> Hydrology and Water Resources Information System for India, National Institute of Hydrology, Roorkee [http://nihroorkee.gov.in/rbis/India\\_Information/draught.htm](http://nihroorkee.gov.in/rbis/India_Information/draught.htm)

Marathwada, namely cotton and sugarcane, were also severely affected. The anticipated impact of climatic change and climate variability presumably led to increased pressure on already scarce water resources.

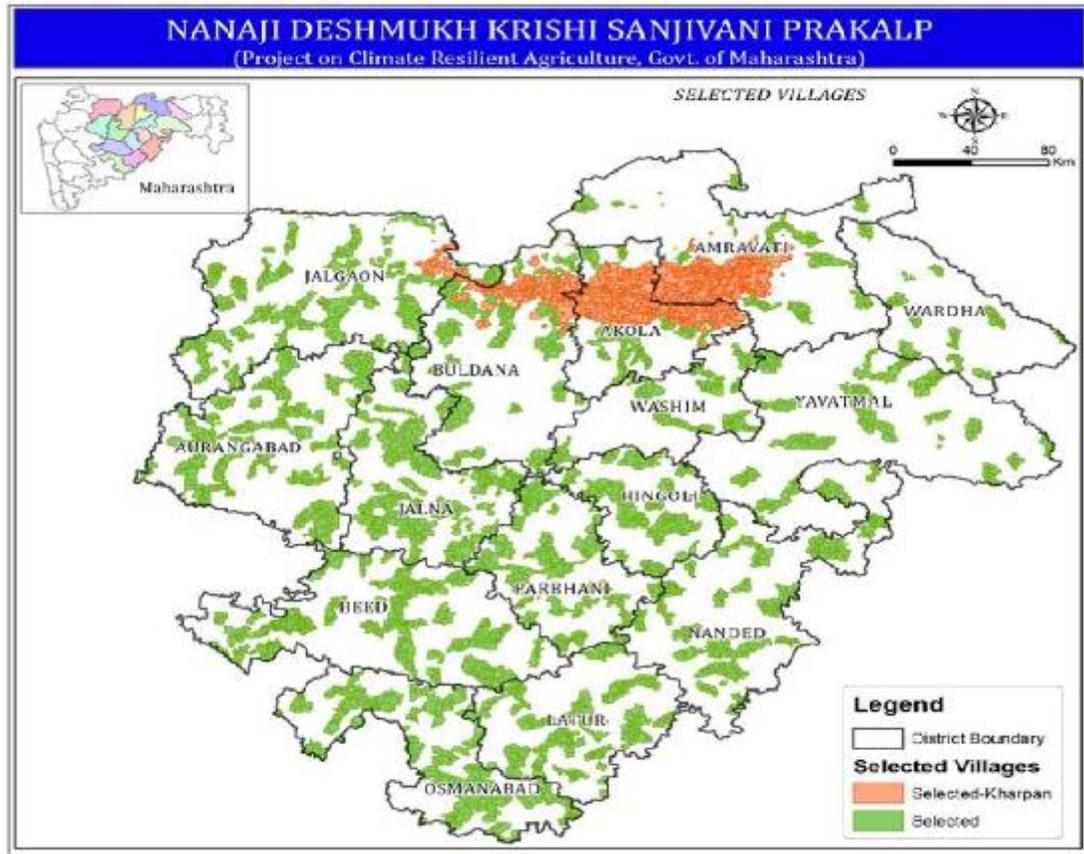


Figure 1 PoCRA Project Area and Villages (Source: <https://mahapocra.gov.in/>)

## 1.2. Strategic Overview of PoCRA Interventions

The strategic overview, thematic linkages, and expected achievements of the project are highlighted in the schematic presented in Figure 2. The overall vision is to contribute toward three critical impact areas: a) Water Security, b) Soil Health, and c) Farm Productivity and Crop Diversification. The emphasis for interventions across these three areas in the region is evident given the type of agro-climatic attributes of the study area as discussed in the previous section.

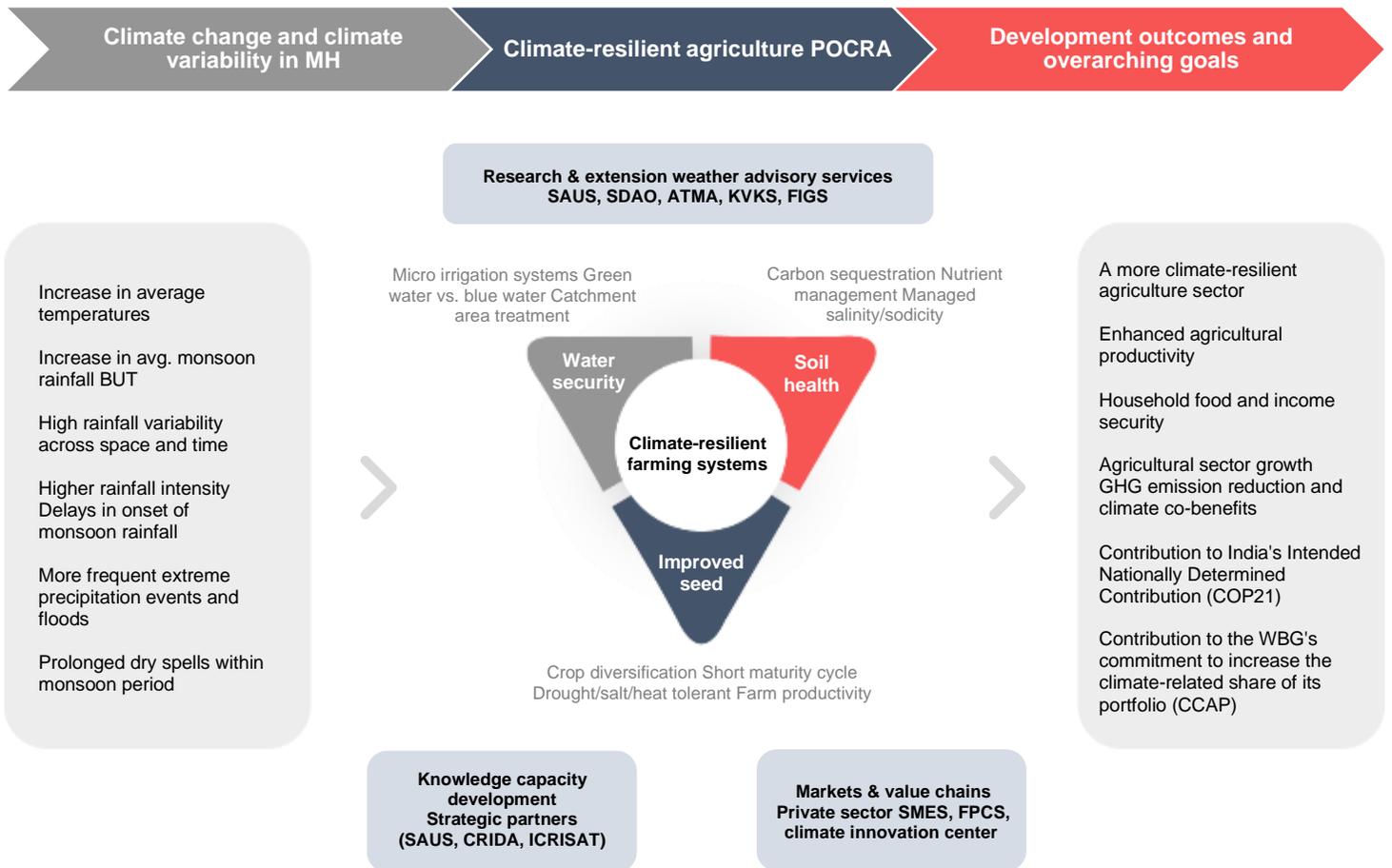


Figure 2 PoCRA strategic overview, thematic linkages and expected achievements

## 2. Project Development Objectives and Midterm Review

The Project Development Objective (PDO) of PoCRA is **to enhance the climate resilience and profitability of smallholder farming systems in selected districts of Maharashtra**. The project is built around a comprehensive, multi-sector approach that focuses specifically on building climate resilience in agriculture through scaling up tested technologies and practices.

### 2.1. Building Climate Resilience in Agriculture System

PoCRA is built around a comprehensive, multi-sector approach that focuses on building resilience in agricultural production systems while generating the following interdependent triple win solutions:

- a. **enhanced water security at the farm level** - through the adoption of technologies for more productive and efficient use of water for agriculture, and the increase in water storage capacity (surface and sub-surface) and improvement in water distribution structures to address on-farm water availability and reduce the risks associated with intra- and inter-seasonal climate variability,
- b. **improved soil health** - through the adoption of good agricultural practices to improve soil fertility, soil nutrient management, promote soil carbon sequestration, and

- c. **increased farm productivity and crop diversification** - by adopting climate-resilient seed varieties (short maturity, drought, and heat resistant, salt-tolerant) and market-oriented crops with a clear potential for income security derived from the integration of smallholder FPCs in emerging value-chains.

## 2.2. Theory of Change

Theory of Change (ToC) identifies the conditions to unfold for the long-term goals of the project to be met. These conditions are arranged graphically in a causal framework. This creates a set of connected outcomes known as a “pathway of change,” which graphically represents the change process. It uses backward mapping from the long-term goal to the intermediate and then early-term changes that would be required to cause the desired change, as can be seen in figure 3.

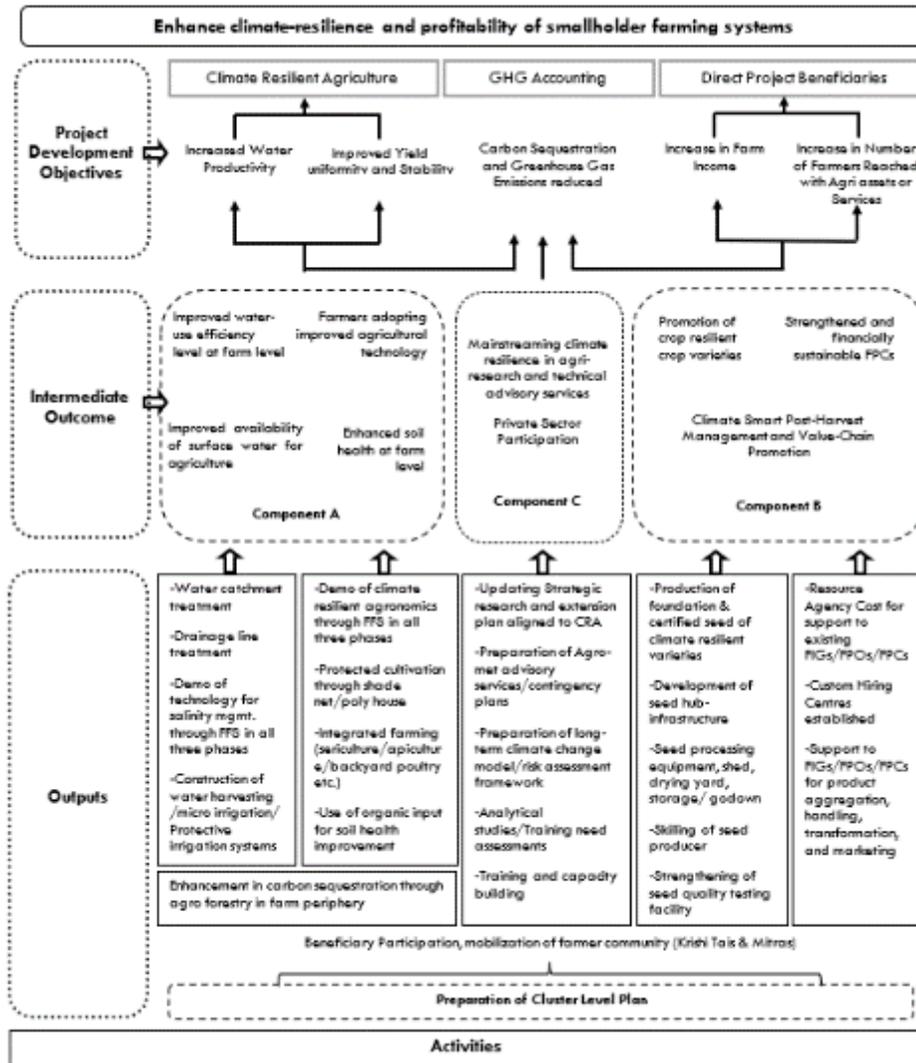


Figure 3 Theory of Change

### 2.3. Approach and Methodology of Midterm Review

The MTR aimed to ensure that the project is progressing on the right trajectory and identify the key challenges and achievements. It also aimed to contribute to course correction by undertaking reparative measures and act as a tool to understand the project status.

The overall objective of the MTR is to assess the extent of targets achieved thus far in the project, understand the determinants enabling and disabling achievement of targets, the extent of awareness within the community, and capture key learnings from the implementation experience and recommend doable actions for the remaining project period.

The MTR uses comparisons to baseline data and assesses the impact by measuring key indicators at the mid-term stage of the project. It adopts the same methodology employed at baseline to ensure comparability of data and results. The MTR also assesses the current situation on relevant variables mentioned in the results framework and on key ESMF-related indicators.

#### Evaluation Design and Sampling Methodology

In line with the methodology mentioned in the inception report, a quasi-experimental design with a Double difference method was adopted for MTR. A robust priori matching was undertaken to match project and comparison clusters to ensure strong attribution of project results. Quasi-experimental designs assisted in identifying a comparison group that is as similar as possible to the project group in terms of baseline (pre-intervention) characteristics. The comparison group was used to capture what would have been the outcomes if the program had not been implemented (i.e., the counterfactual). As shown in figure 4, the difference between  $\Delta M$  and  $\Delta B$  will give the net impact due to the project at this intermediate stage. This double difference will again be estimated at the end of the project to evaluate the impact between baseline-endline and MTR-endline time-period.

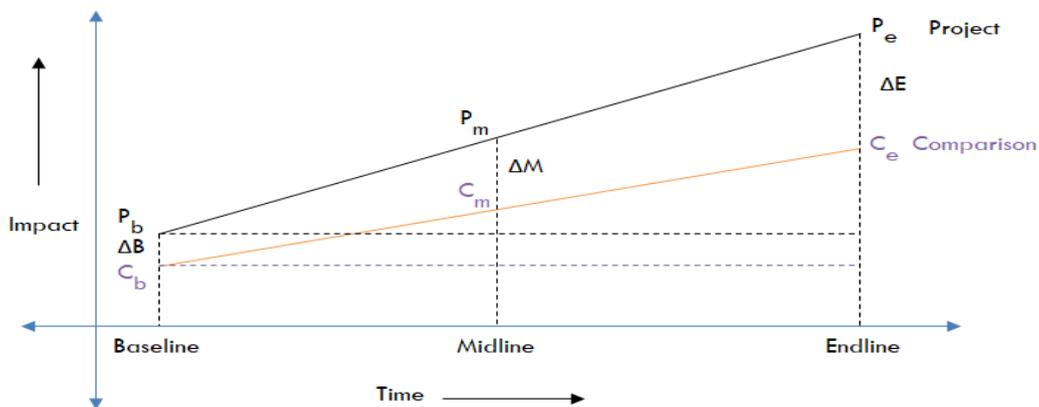


Figure 4 Difference-in-Difference evaluation method

#### Constructing a Comparison Group

For stronger attribution of the impact of the project, counterfactual has been taken for each sampled project cluster and village. Therefore, the ratio of the project to comparison is 1:1. The first step of the matching exercise was to match the project clusters of a particular district with the non-project clusters of the same district. A comparison cluster has been identified for each of the project clusters. Comparison clusters were matched with project clusters based on their respective climate vulnerability index score. As the PoCRA project is focused on climate resilience, the climate change vulnerability index (as defined by IPCC-2011) was deemed suitable for matching and selecting the comparison clusters. The villages were further selected from the matched clusters. One-to-one matching technique was used to find the closest match to every project cluster

in the same district. Finally, the comparison cluster corresponding to the sampled project cluster was selected for the survey.

## Sampling Methodology

### Sample Size

The MTR survey team adhered to the sample distribution provided in the ToR by PoCRA PMU. The data and distribution of samples across clusters, villages, and households level has been done to account for a minimum detectable impact (MDI) at the project level. To conform to the sample proposed and ascertain MDI, the team accounted for intra-class correlation and estimated the design effect equaling  $\rho(m - 1) + 1$ , where  $\rho$  is the intra-class correlation coefficient (ICC), and  $m$  is the average number of observations per cluster. The sample thus provides 80% power to detect the minimum change at a 0.05 level of statistical significance<sup>6</sup>. The sample size estimation has been done using the below-mentioned formula:

$$MDI = 2.8 * \sqrt{b(1 - b)} * \sqrt{\frac{1}{P(1 - P)} \left( \frac{\rho_c(1 - R_c^2)}{N} + \frac{(1 - \rho_c)(1 - R_l^2)}{rN} \right)}$$

1.  $b$  is the baseline prevalence rate of a binary outcome (0.5<sup>7</sup>)
2.  $P$  is the fraction of the sample in the treatment group (0.5)
3.  $\rho_c$  is the intraclass correlation (ICC), i.e., the proportion of variance among catchment areas (0.02)
4.  $R_c^2$  and  $R_l^2$  are the regression R-squared values at the cluster and individual level, respectively (0.3)
5.  $N$  is the total number of catchment areas selected
6.  $r$  is the total number of respondents in each catchment area

The estimated sample size (number of households or respondents) that were targeted to be covered in the project and comparison area was 2410 each. This proposed sample size is powered to have an MDI (minimal detectable impact) of 5%. The table below provides the overall sample for MTR.

Table 1 Sample Size for MTR evaluation

Phase	Cluster		Villages		Households	
	Project	Comparison	Project	Comparison	Project	Comparison
Baseline						
Mid Term	241	241	482	482	2410	2410
End Term						
Total (each phase)		482		964		4820

<sup>6</sup> The sample size reflects 95% Confidence and 10% margin of error (ToR, page 84)

<sup>7</sup> Maximum rate of prevalence

## Sampling Distribution

The sampling distribution approach adopted for this study has been detailed below. A multi-stage sampling method was adopted for this study. The table below details the rolling sampling approach used for the MTR.

Table 2 Sampling distribution of cluster for MTR

Total Project Cluster	Baseline	Midterm	Endline
347	241 out of 347	- 121 fixed out of 241 baseline clusters	- 121 fixed out of 247 MTR clusters
	Random Selection	- 120 out of the remaining 226 project clusters	- 120 out of the remaining project clusters
		- Total 241 out of 347 clusters	- Total 241 out of 347 clusters

\*During midterm, 120 clusters selected during baseline were dropped. Those dropped clusters would also form a part of the remaining 226 project cluster from which a new set of 120 clusters would be sampled.

\*\*Comparison cluster corresponding to each sampled project cluster will be sampled.

The steps that have been adopted as part of the multistage sampling for the midterm have been detailed below:

### Selection of Districts

All the eight project districts in the Marathwada region were covered, namely Aurangabad, Bid, Jalna, Latur, Osmanabad, Nanded, Parbhani, and Hingoli.

### Selection of Clusters

As the next step, the project clusters were selected proportionately (in line with the ToR) from each district, which has been presented in the table below. Non-PoCRA clusters were matched with the PoCRA clusters based on the climate vulnerability index in each district. Subsequently, the sampled clusters were chosen from the total number of clusters in each district using a simple random sampling methodology. For e.g., 37 PoCRA clusters were chosen from 58 PoCRA clusters in Aurangabad using simple random sampling. Subsequently, the corresponding matched comparison clusters for sampled project clusters were also chosen for the MTR survey. This procedure was followed for all eight districts in the Marathwada region to select a total of 241 project and 241 corresponding comparison clusters.

Table 3 Distribution of sample in proportion to district cluster size

District	No. of talukas	Total number of clusters	Total no. of clusters chosen	Total no. of project villages chosen	Total no of control villages	Total villages to be surveyed	Total households to be surveyed
Aurangabad	9	58	37	74	74	148	740
Beed	11	37	27	54	54	108	540

District	No. of talukas	Total number of clusters	Total no. of clusters chosen	Total no. of project villages chosen	Total no of control villages	Total villages to be surveyed	Total households to be surveyed
Jalna	8	54	35	70	70	140	700
Latur	10	42	30	60	60	120	600
Osmanabad	8	58	37	74	74	148	740
Nanded	16	34	26	52	52	104	520
Parbhani	9	39	28	56	56	112	560
Hingoli	5	25	21	42	42	84	420
Marathwada	76	347	241	482	482	964	4820

### Selection of Villages

Subsequently, in each cluster, two villages were selected on a random basis. As such, a total of 482 villages each in project and comparison clusters were selected for the evaluation. In cases where a sampled cluster had only one village, a sample of ten instead of five was taken from that village as per the methodology agreed upon in discussion with the PMU team.

### Selection of Households

On assessing the various components of the PoCRA project, it can be said the project components like FFS, community interventions, and FPO/FPCs are targeted toward all categories of farmers in the project villages. The landless people were also eligible for benefits under PoCRA. Therefore, all residents of the village were identified to be potential beneficiaries of PoCRA and were included to be part of the sample frame. In line with the ToR, five households were selected from each village while ensuring geographical representation. For this, a village habitation map of each sampled village was prepared, during which the approximate number of households (HHs) in the village was initially identified. Further, a systematic interval sampling was followed to sample the HHs for the survey. The primary respondent of the survey was the land owner based on land records or any adult member of the HH involved in agriculture activities. The HH head or any adult family member was selected in the case of landless households.

### Qualitative Survey

Along with the quantitative survey, a qualitative survey was also conducted as part of the MTR. It aimed at understanding the challenges faced by the beneficiaries and the bottlenecks in the execution of the project. Also, field observations were made by experts and research team members to understand the situation in project areas. The qualitative interviews that were conducted along with the sample size have been presented in the below matrix:

Table 4 List of qualitative research tools

Target Respondent	Sample	Enquiry Technique	Remarks
FGDs with potential beneficiaries i.e., farmers with more than 5 acres, farmers with less than 5 acres, landless farmers	24 (16 in project area and 8 in comparison area. Distributed equally amongst the three categories of target respondents)	FGD with community members	-Feedback on challenges faced in agriculture and the key challenges faced related to climate change and the coping mechanisms adopted  -Feedback on the PoCRA intervention and the challenges faced by them in accessing project benefits
FGD with VCRMC (in Project villages) and Gram Krishi Vikas Samiti (in Control villages) Members	24 (16 in project area and 8 in comparison area. Distributed equally in 8 districts of Marathwada region)	FGD with VCRMC and GKVS members	-Feedback on challenges faced by committee members in implementation of PoCRA and agriculture dept activities in project and control villages, respectively.
IDI with FPC/FPO Representatives	24 (Distributed equally in 8 districts of Marathwada region)	IDI with FPC/FPO Representatives	Feedback on challenges faced by their FPC/FPO, on the support through PoCRA and support that can help them in increasing the income of its member farmers
IDI with Self Help Group (SHG) Representatives	24 (Distributed equally in 8 districts of Marathwada region)	IDI with SHG representatives	Feedback on the current activities and challenges faced by SHGs, on the support through PoCRA and what can be done to strengthen them

### 3. Key Results from Midterm Review

#### 3.1 Socio-Economic Profile of Respondents

Under PoCRA, the project components benefit not only their primary target population of smallholder farmers (having landholding less than 2 hectares) but also other categories in the project villages. This is because besides providing matching grants to smallholder farmers, support were also provided to landless farmers for activities like ruminant rearing and Custom Hiring Centre (CHC). The project also aims to increase the groundwater level and water availability through community watershed interventions, like catchment treatment, drainage line treatment, and repair of old water harvesting structures, which benefit all farmers within the watershed area. The survey team analyzed the distribution of various socio-economic and demographic factors across the project and comparison study area to check if the respondents across the project and comparison arm are balanced. Below are the results of the quantitative findings. Nearly 5% of respondents in project areas and 4% in comparison areas were from PESA villages.

##### 3.1.1. Family and Gender Composition

Around 20% of respondents stayed as nuclear family, and the rest 80% were part of a joint family. The household size in both project and comparison areas is six. Of the respondents interviewed for the MTR survey, the project had around 6% female respondents, and the comparison area had approximately 4% female respondents. In the respondent profile during baseline, 10% of respondents were female in both project and comparison areas.

Table 5 Distribution of gender of the respondent in project and comparison area

Gender	Project		Comparison	
	N	%	N	%
<b>Baseline</b>				
Male	2171	90	2169	90
Female	239	10	241	10
<b>MTR</b>				
Male	2264	94	2306	96
Female	146	6	104	4

The gender of the household head was primarily male, with 95% in project and 97% in comparison area reporting so. The confidence intervals in the proportions are found to be overlapping, implying that there is no significant difference across project and comparison in the distribution of gender of respondents and that of HH head.

Table 6 Proportion of gender of household head in project and comparison area

Gender	Project		Comparison	
	N	%	N	%
<b>Baseline</b>				
Male	2347	97	2362	98
Female	63	3	48	2
<b>MTR</b>				
Male	2299	95	2334	97
Female	111	5	76	3

### 3.1.2. Distribution based on Economic Categories

In both project and comparison clusters, around 62% belong to Above Poverty Line (APL) category, and around 36% belong to Below Poverty Line (BPL) category. The remaining informed that they were unaware or did not have an APL/BPL card. During baseline, around 51% and 43% of the respondents reported belonging to APL and BPL categories, respectively, in both project and comparison areas. When compared with the respondent profile of baseline, it is observed that during MTR, there is a reduction by around 7% in the percentage of respondents covered under the BPL category in both project and comparison areas.

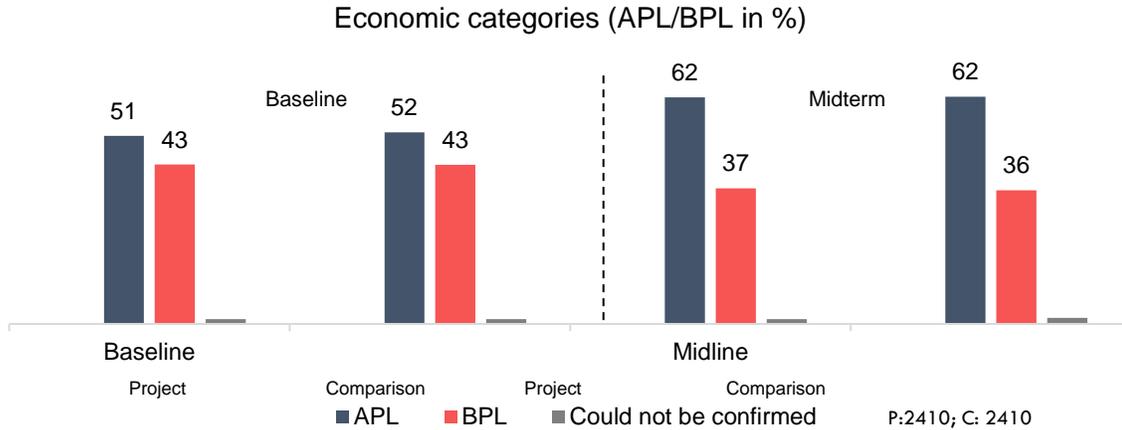


Figure 5 Distribution of APL/BPL

### 3.1.3. Distribution based on Social Categories

When enquired about their social category, around half of the respondents reported being belonging to the general category (Project: 51%; Comparison: 50%), followed by Other Backward Classes (Project: 19%; Comparison: 21%), Scheduled Castes (Project: 11%; Comparison: 11%), Nomadic Tribes (Project: 10%; Comparison: 11%), and Scheduled Tribes (Project: 7%; Comparison: 4%). Here too, no significant difference has been observed across project and comparison. The respondent profile based on the social category in MTR is like that observed in the baseline respondent profile.

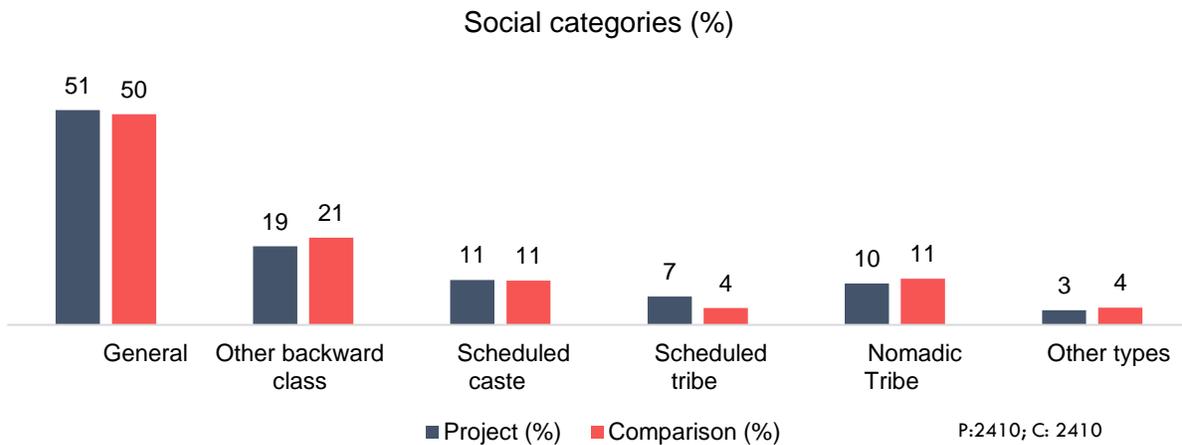


Figure 6 Distribution of social category

### 3.1.4. Distribution based on Educational Qualification

The respondents were enquired about their educational qualifications and the highest qualification attained by any other member of their household. Around 9% of respondents in both project and comparison areas reported that no member of their household had received any formal education. Nearly one-fourth of

respondents in both areas were found to have completed secondary schooling (till 10<sup>th</sup>), and one-fifth of respondents have completed senior secondary (till 12<sup>th</sup>).

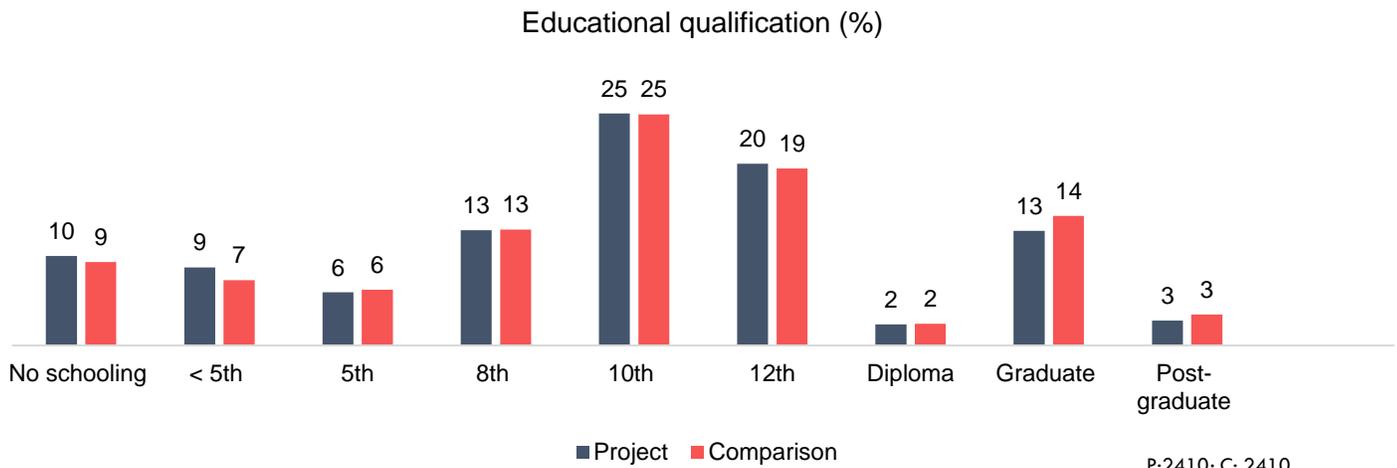


Figure 7 Distribution of highest education qualification of any household member

In response to the question on the highest qualification attained by any other member of their household, one-fourth of respondents in both areas reported graduation, and about 7% reported post-graduation. It was observed that the percentage of respondents under each level of education qualification is the same in both project and comparison areas. This was also observed in respondents' profiles of the baseline survey.

### 3.1.5. Distribution based on Source of Employment

When asked about employment, 89% of respondents in both project and comparison areas reported that they are dependent on farming. Next to farming, agricultural laborer activity was found to be the second most important source of employment, with 38% of respondents in the project and 41% of respondents in comparison areas reporting the same.

Table 7 Sources of employment of respondent household members in project and comparison areas (Fig in %)

Sources of employment	MTR Project*	MTR Comparison*	Baseline Project*	Baseline Comparison*
<b>Farming</b>	89	89	82	83
<b>Agricultural labor</b>	38	41	57	62
<b>Agri allied activities</b>	14	12	28	30
<b>Non-agricultural labor</b>	2	3	19	16
<b>Service/salaried worker</b>	5	6	7	8
<b>Small/cottage industry</b>	2	1	3	3
<b>Petty business/shop</b>	3	3	7	6
<b>Business/trader</b>	2	1	2	2
<b>Self-employment</b>	2	1	3	3
<b>Skilled worker</b>	2	2	5	6
<b>Others</b>	1	1	3	4
<b>Total</b>	100	100	100	100

\*Multiple Response, N = 2410

This also reflects that nearly half of respondent households who are dependent on farming are also working as agricultural laborer and this is slightly more in comparison areas than project areas. Around 14% respondent households in project area and 12% respondents in comparison area also undertake allied activities (livestock rearing, dairy, herding etc.). Apart from above sources, 2% to 5% respondent households in project and comparison areas also reported service, trading, skilled work, etc. as source of employment.

### 3.1.6. Sources of Income

Apart from income from crop production, the respondents were also enquired about their Agri-allied and non-agriculture income. The current farm income (including agriculture and Agri-allied) is presented in the key indicators from the results framework section.

The respondents across the project and comparison were asked if they were involved in agriculture allied activities like dairy, honey, wool, etc. Overall, it was found that 16 % across the project and 14% across the comparison were engaged in the dairy activity. About 11 % of respondents in the project area and 9 % of respondents in the comparison area reported being engaged in rearing livestock. The uptake of other Agri-allied activities is almost negligible in the project area. The respondents were also enquired about their non-agriculture income from different sources. Agriculture labor, business, and remittance are the three prominent non-Agri sources of income for the respondents apart from their income from agriculture. The contribution of different non-Agri sources in the mean non-Agri income in project and comparison areas have been presented in the table below.

Table 8 Non-Agri Source of Income of Respondents in Project and Comparison Areas (Fig in %)

Non Agri Source of Income	Project*	Comparison*
<b>Agriculture Labor</b>	18	23
<b>MGNREGA</b>	1	2
<b>Other labor</b>	4	5
<b>Salary</b>	10	12
<b>Business/ Own enterprise</b>	10	11
<b>Remittance</b>	24	36
<b>Rent on lease out land</b>	32	10

\*Multiple Response, N = 2410

### 3.1.7. Level of Migration

During the MTR, the migration rate in the project area was found to be 2.2 percent, and in comparison, area this was 2.7 percent. The major reason for migration in both project and comparison areas are no or lesser livelihood opportunities available followed by higher-income opportunities outside, loss of farming due to climate variability, and low crop production resulting in low income. During baseline, the migration pattern was reported to be between 5% to 25% across villages. Therefore, the project has contributed to reducing the migration to below 2.5 percent.

### 3.1.8. Distribution of Land Ownership

As part of the MTR evaluation survey, the status of the land ownership across project and comparison areas was assessed. The respondents were asked if they owned or had leased-in land for cultivation.

#### Size of Land Owned and Social Category

Based on the size of land ownership, the respondents were classified into three categories i.e. small/ marginal farmers having land less than 2 hectares, medium farmers owning between 2 to 5 hectares of land, and large farmers having land more than 5 hectares. Those who did not own land or practice agriculture were categorized as landless. As can be seen from the table below, the respondent profile, nearly two-third of respondent households in the project and comparison areas belonged to small/marginal farmers, and around one-tenth of respondent households were landless.

Table 9 Category of respondents covered in the household survey

Land size	Project (Total N = 2410)				Comparison (Total N = 2410)			
	<2Ha	2-5Ha	>5Ha	Landless	<2Ha	2-5Ha	>5Ha	Landless
<b>Sample</b>	1573	532	28	277	1574	505	39	292
<b>Percent</b>	66	22	1	11	66	21	1	12
<b>Social group (%)</b>								
<b>General</b>	53	55	64	30	51	57	62	31
<b>OBC</b>	18	20	18	20	21	22	23	18
<b>SC</b>	11	5	0	22	9	6	0	26
<b>ST</b>	6	6	0	13	3	4	5	9
<b>NT</b>	10	9	7	11	11	9	5	13
<b>Others</b>	2	5	11	4	5	2	5	3

The mean of land owned by respondent farmers in both project (N = 2133) and comparison (N = 2118) areas is approximately 4 acres.

#### Land Ownership based on Gender

To understand the land ownership profile of respondents by gender, the respondents were enquired about the ownership of the land as per the land records. It is observed that 4% of respondent households in the project area and 2% in the comparison area had the land owned only by the female member. The land was in the name of both male and female members in nearly 6% of households in the project and 5% in the comparison area. Hence, it is evident that in the majority of households, i.e., 90% in project and 93% in comparison, agriculture land is in the name of the only male member.

#### Land Leasing -In and -Out

It is observed that a very small percentage of farmers in both project and comparison areas are involved in land leasing -in and -out. When compared with the respondent profile of baseline, the percentage has reduced from about 6 percent down to around 1.5 percent in MTR. The number of respondents leasing-in land in both project and comparison areas is 36 percent, and their mean leased-in land is approximately 4 and 3.5 acres, respectively. Twenty (20) percent of respondent farmers in the project and 14 percent in comparison areas leased out an average of 3 acres and 1.3 acres of land respectively.

### 3.1.9. Participation in Social Institutions

A very small percentage of households (3% in project and 2% in comparison) reported that at least one of their family members is part of a farmer Producer Company (FPC). Nearly 8% of households in the project and 10% in comparison areas reported that at least one of their family members is part of either district/block/village panchayat (holding positions like Sarpanch, Deputy Sarpanch, Police Patil, Panchayat Secretary, Ward member, Teacher, FPC/SHG office bearer) or market committee/agriculture produce market committee (APMC). A good percentage of respondent households, i.e., 44% in project and 42% in comparison areas, reported having membership in Self-Help Groups (SHGs). Given the status of household participation in various community institutions, it is evident that there is still huge scope for improving the involvement. Similar composition of participation in social institutions was observed in respondents' profiles in baseline survey.

### 3.1.10. Awareness and Participation in PoCRA

During the mid-term household survey, 86 % of the total 2410 respondents in project clusters were aware of PoCRA project being implemented in their village. There was high awareness about different types of benefits that can be accessed under PoCRA, such as matching grants for the purchase of micro-irrigation systems, pumps, pipes (94%), construction of farm ponds (62%), construction of polyhouse/ shade net (63%), setting up sericulture/ apiculture/ inland fisheries units (49%), horticulture plantation (36%), recharge of open dug wells (14%), production of certified seeds (13%), and repairing existing water harvesting structures (13%). The primary source of information about the project is from Gram Sabha meetings (69%), VCRMC members (28%), and Project staff (36%). Of those who were aware, nearly 52% have availed the benefits of the project. The majority of them (96%) received matching grants for individual activities, around 2% benefitted each from participation in FFS and NRM works, and 6% benefitted from agribusiness activities in a project supported FPCs/ SHGs. The poor participation in FFS is attributed to reasons such as difficulty in understanding the technology (96%), unaware of FFS timings (94%), unable to find time due to personal work (75%), and unaware of the FFS schedule (40%).

Some of the key observations from 19 beneficiaries who participated in FFS are presented as follows. Cotton and Soybean are key crops for which FFS sessions are attended. Other crops include Chickpea, Maize, and Onion. Key benefits accrued from FFS participation are awareness of good agricultural practices, better utilization of inputs, better pest and nutrient management.

The construction of NRM works benefits the farmers whose farm fields are in and around those structures. During MTR, 14 respondents benefiting from NRM works were interviewed. Type of NRM works from which respondents benefited are compartment/ graded bunds, continuous contour trench, earthen Nala bunds, loose boulder structures, and agroforestry. Key benefits accrued from the NRM structures are increased availability of water for protected cultivation and during dry spells, increased area of cultivation during rabi and summer season, increase in yield/ production, increase in income, and change in cropping pattern.

During MTR, responses from 65 farmers benefiting from agri-business activities in project-supported FPCs/SHGs/FIGs were captured. Key benefits accrued from the agri-business activities are access to tools and equipment through custom hiring centers, marketing support in selling Agri produce, support in purchasing seeds and fertilizers, grading, sorting, and value addition to agricultural produce.

## 3.2. Component A: Promoting Climate Resilient Agriculture Systems

### 3.2.1. Increase in cultivable land during Rabi and Summer Seasons

Cultivable land is defined as arable land that has been used for sowing crops (field or fruit crops). We have calculated the percent of cultivable land as cultivable land from the total land owned by the farmers. It is observed that, on an average, 92% of the owned land is cultivable in the project and 95% in comparison. The mean of cultivable land as reported by the respondent farmers in both project (N = 2133) and comparison (N = 2118) areas is approximately 3.7 acres.

### Land cultivated under different seasons

This section captures the agricultural land ownership, cultivation, and irrigation practices of the respondent for the last 12 months (Kharif-2020, Rabi 2020/21, Summer- 2021). The farmers were also enquired about the land they had cultivated in different seasons in the last one year. It is observed that the Kharif season sees the highest cultivation (P: 91%; C:94%) followed by Rabi (P: 51%; C:48%) and summer season (P:10%; C:6%). When compared with the baseline estimates, a significant improvement in the land utilization in Rabi and Summer seasons in both project and comparison areas was observed. However, slightly more improvement was observed in the project than in the comparison area, which can be attributed to the intervention of PoCRA. The mean area of land cultivated in the Kharif season is around 3.5 acres in both project (N = 2036) and comparison (N = 2090) areas. The same in Rabi season is around 3 acres in both project (N = 1376) and comparison areas (N = 1298). The mean area of land cultivated in the summer season is 2.5 acres in project (N = 361) and 2 acres comparison (N = 207) areas.

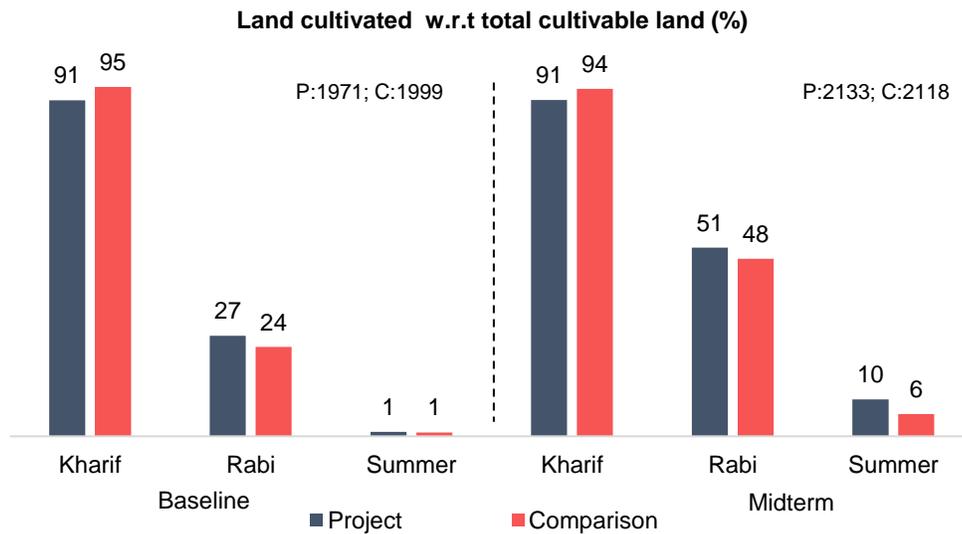


Figure 8 Land cultivated under different seasons

### 3.2.2. Positive Impact on Irrigation Practices

As the area targeted by PoCRA is rainfall dependent and drought-prone area, irrigation plays a crucial role in agricultural production. This section presents the situational analysis of access to irrigation and irrigation practices of the farmers of the Marathwada region. This would help in understanding the ground situation in the project areas and improve project implementation. Also, estimates of baseline and MTR surveys are compared to understand if any change is observed over time.

#### Ease of Access to irrigation

During MTR, the farmers were enquired if they have any source of irrigation for the land they cultivated. Approximately 78 percent of farmers in the project and 59 percent of farmers in comparison areas reported to have access to irrigation source for their land. This has significantly improved when compared to the respondent profile in baseline, which was 49 percent in the project and 47 percent in comparison areas.

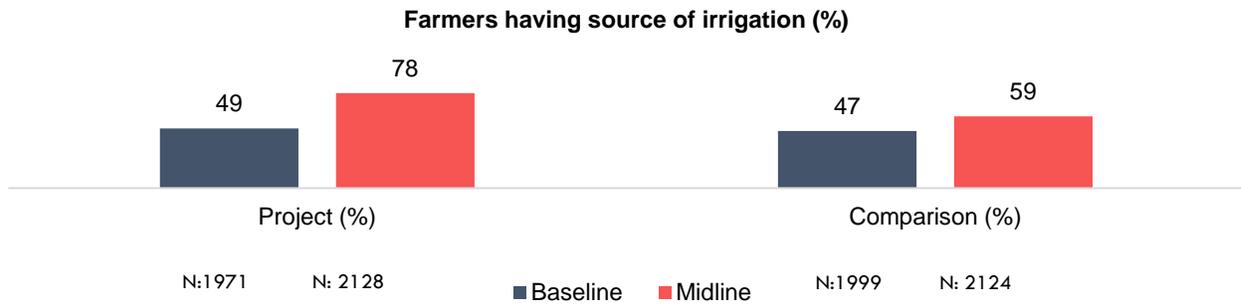


Figure 9 Farmers with a source of irrigation for their land

### Increased cultivated land under irrigation

Cropping season-wise percentage of cultivable land under irrigation across both project and comparison areas were analyzed. As evident from the below figure, the percent of cultivated land under irrigation has increased in both project and comparison areas when compared with the baseline. The increase is more prominent in the project area than in the comparison area, which is a positive indication of the adoption of better irrigation practices by the farmers in project areas. During Kharif season, 55 percent of total cultivated land in the project and 39 percent in comparison was reported to be under irrigation. Similarly, during rabi, 86 percent of total cultivated land in the project, and 73 percent in the comparison area were reported to be irrigated. During the summer season, nearly 94 percent of cultivated land was irrigated in the project area. The mean of land under irrigation during the Kharif, Rabi and Summer seasons in both project and comparison areas is 3.4, 3, and 2.5 acres, respectively.

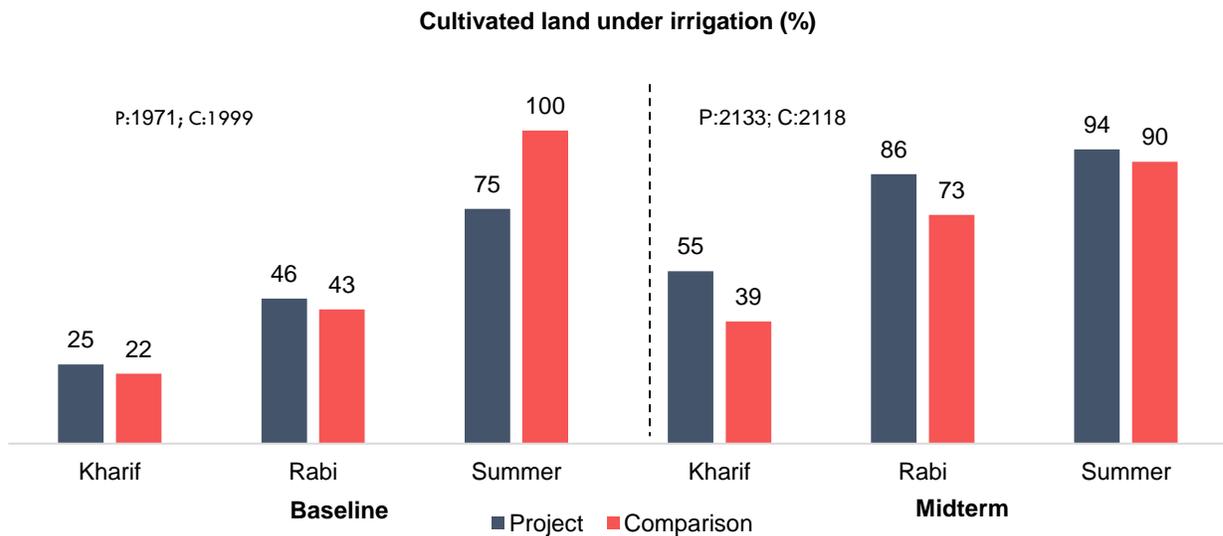


Figure 10 Cropping season-wise percentage of total cultivated land under irrigation

### Source of irrigation

When enquired about the source of irrigation, nearly 98 percent of respondents in the project area reported having their own source. Similar was the case in the comparison area where about 95 percent of respondents had their own source. The remaining farmers either borrow or get it from other farmers. It is observed that in part 12 months, 39 percent of farmers in the project and 65 percent in the comparison region have spent on average of Rs. 4000/- and Rs. 8200/- for purchasing water for irrigation. About 10 percent of respondents in the project and 6 percent in comparison shared that they had rainwater harvesting structures like earthen nala bund, farm pond, check dam, and well recharge near their fields. Open dug well (reported by three fourth of respondent farmers) and bore well (reported by one-tenth of respondent farmers) are two main sources of

water for irrigating cultivated land in both project and comparison areas. Nearly half of these open dug wells in both regions are surrounded by a fence or protective wall. In both regions, the average level of water in the open dug well during monsoon, winter, and summer is reported to be approximately 35 feet, 22 feet, and 12 feet, respectively.

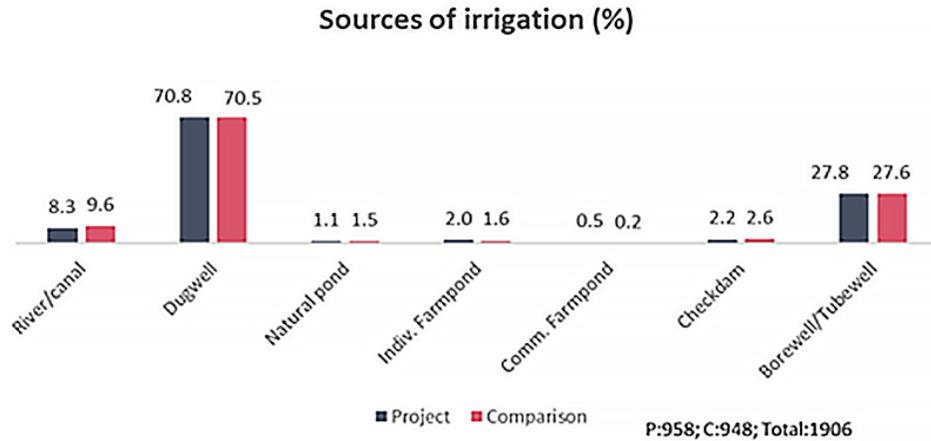


Figure 11 Sources of Irrigation

About 50 percent of farm ponds in project areas (out of 37) are filled with groundwater, and the rest depend on surface /runoff water. In case of comparison, 30 percent use groundwater for filling the pond. Nearly 25 percent of farm ponds in project areas and 13 percent in comparison areas were also used for inland fisheries.

### Improved availability of water for irrigation when required

With those farmers having the source of irrigation for their land, it was further enquired if they get water from their source when they require it for irrigation. The availability of water for irrigation when required, the situation

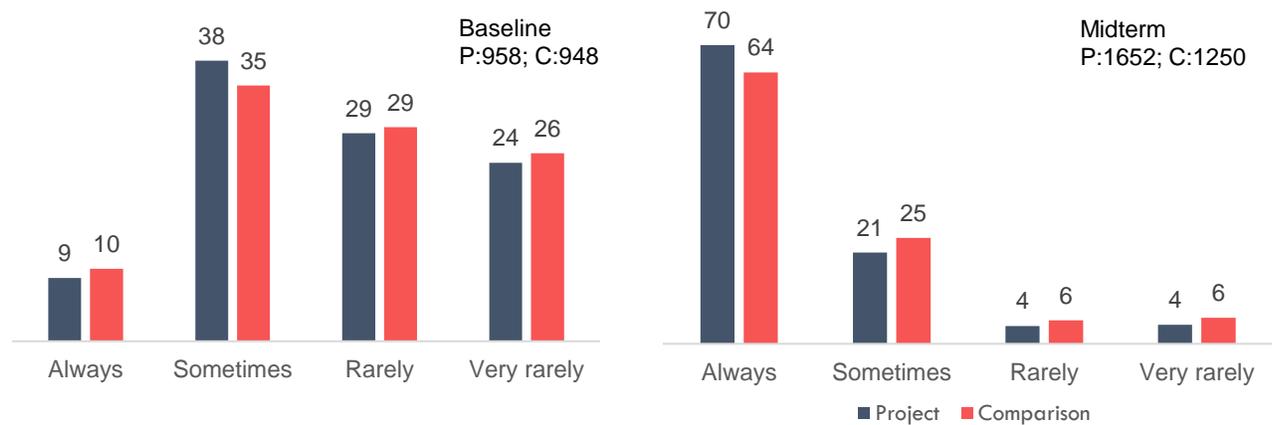


Figure 12 Availability of water for irrigation when required

has improved in MTR when compared to that observed in the baseline respondent profile. During baseline, 10 percent of respondent farmers in both project and comparison regions had reported that they always have water for irrigation available when required. The percentage has increased by nearly 60 percent in MTR respondent profile.

### Pumps and water pipes for drawing water

Nearly 60 percent of the farmers in project and comparison areas used electric pumps, 30 percent used electric submersible pumps, and remain 10 percent used diesel pumps for drawing water from the source for irrigation. Nearly half of the respondent farmers in both regions reported that the pumps were star rated. Nearly 15

percent of them were unaware of this information. Nearly 90 percent of the respondents in both the project and comparison area also used PVC pipes for the transfer of water from the source to the field. The mean distance covered by pipes to transfer water is around 360 metres. The average length of pipes was 372 metres in the project area and 358 metres in the comparison area.

### Increased use of micro-irrigation systems

As evident from the table below, nearly 60 percent farmers in project and 80 percent in comparison use flood irrigation by pump drawing water either through well or tubewell. The percentage of farmers using drip and sprinkler in project is significantly higher in project areas than comparison. This can be attributed to efforts undertaken by PoCRA in promotion of use of micro irrigation techniques. During baseline, flood irrigation was the most common method used, followed by drip irrigation, sprinkler irrigation and manual irrigation. The diagrams below highlight types of irrigation in project and comparison areas during baseline and MTR.

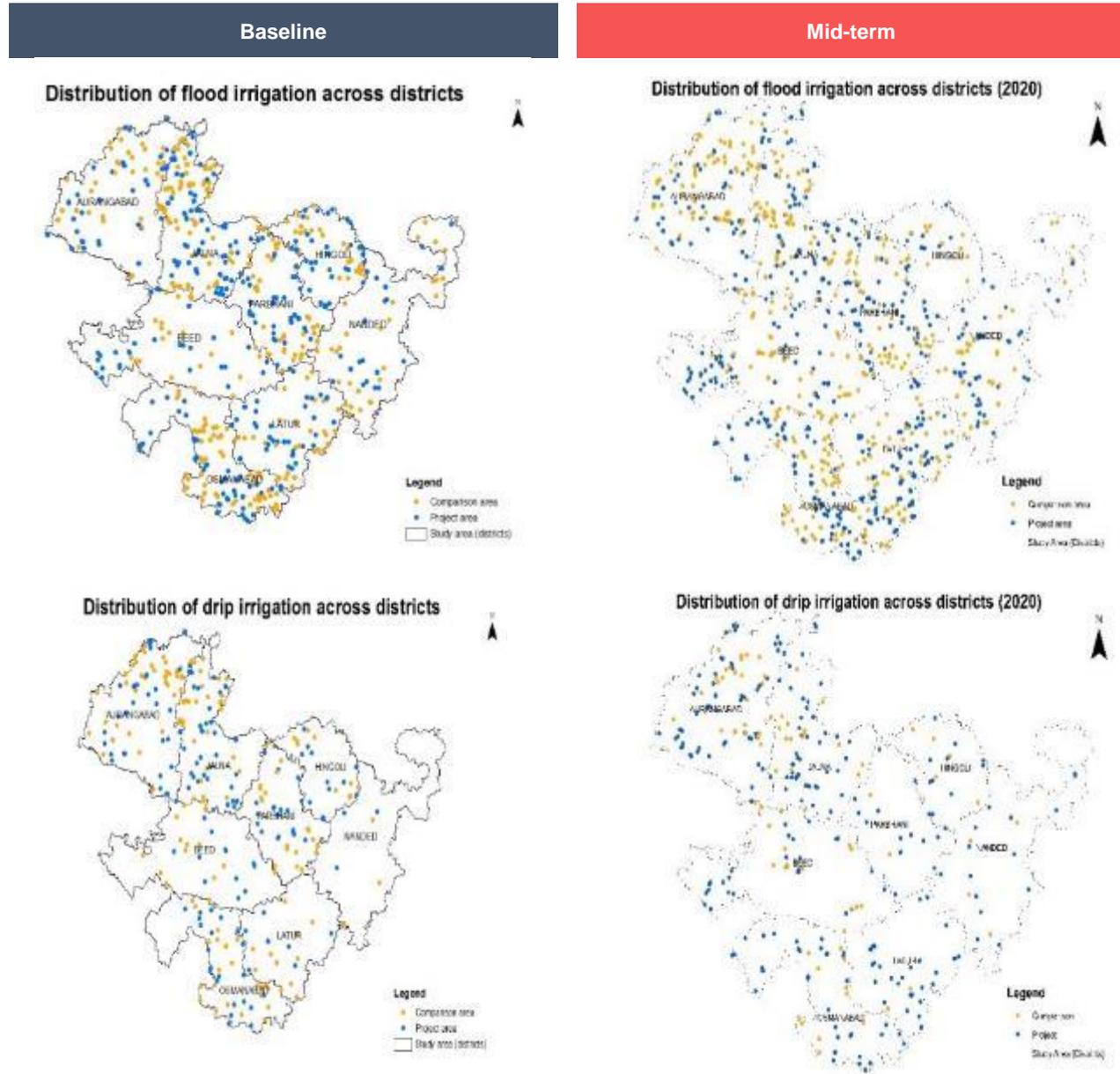


Figure 13 District wise use of different types of irrigation systems

As is evident from figure 13, the flooding practice of irrigation has reduced in many of the project districts, and use of minor irrigation (drip, sprinkler) has increased.

### GIS Maps for Spatial Analysis of Use of Different Irrigation Systems

The MTR team made efforts to understand the irrigation practices across districts through GIS mapping. For this, whole areas were mapped for the method of irrigation practiced using GIS. The blue dots were used for respondents from project area and orange for respondents from comparison area. This GIS maps are presented below.



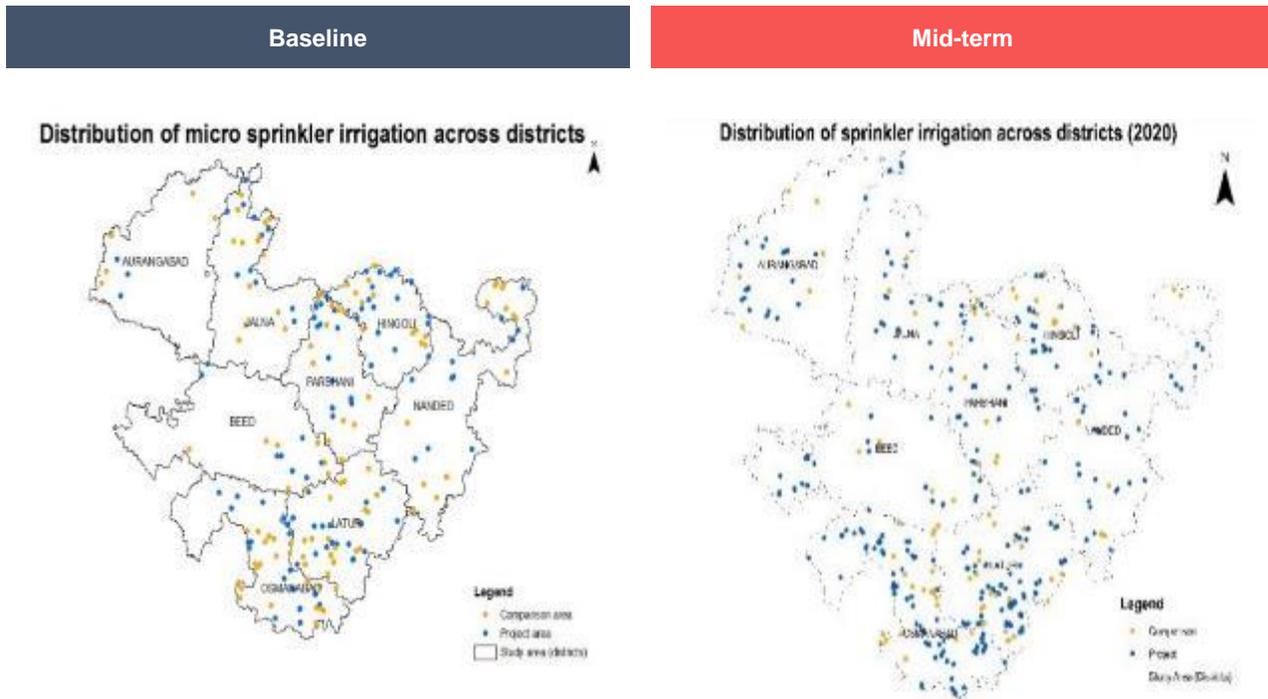


Figure 14 GIS maps of spatial analysis of use of different irrigation across districts

### Season wise area of land under irrigation

As can be seen from the table, more land was under micro irrigation in project areas than in comparison area. Sprinkler irrigation seems to have more preference than drip in both regions. Nearly 17% of total irrigated land under kharif season in project region with mean area of 2.7 acre was drip irrigated. Similarly, for Rabi and

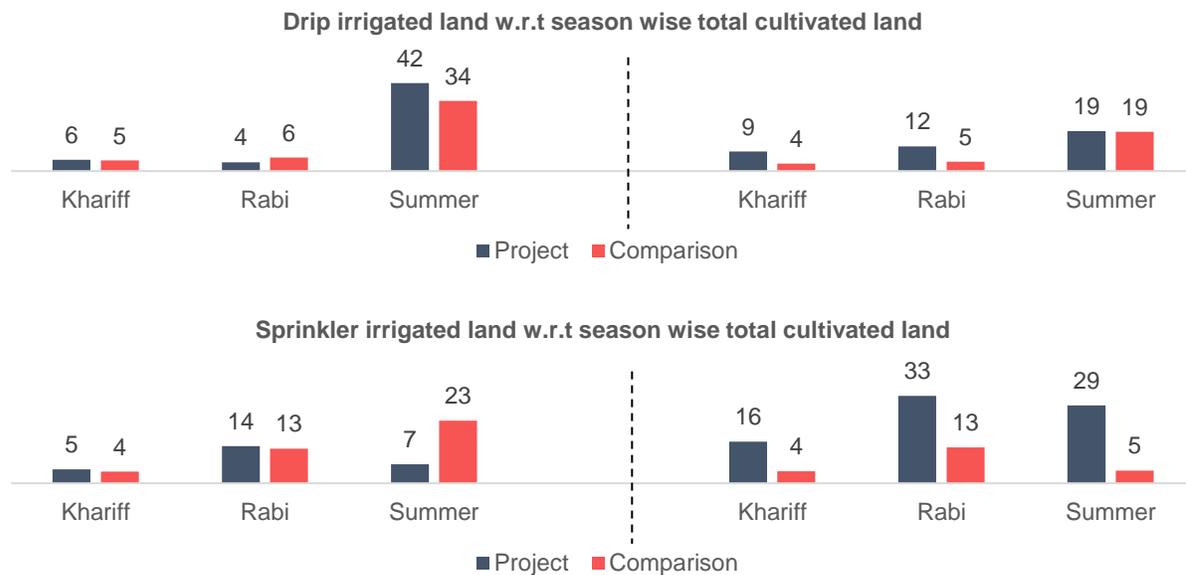


Figure 15 Season wise area of land under drip and sprinkler

Summer season, 14% and 16% of total irrigated land with mean area of 2.4 and 1.2 acres was drip irrigated respectively.

In case of sprinkler, nearly 28% of total irrigated land under kharif season in project region with mean area of 3.4 acre was sprinkler irrigated. Similarly, for Rabi and Summer season, 38% and 25% of total irrigated land with mean area of 3 and 2 acres was sprinkler irrigated respectively.

### 3.2.3. Positive Impact on Cropping Intensity and Crop Diversification

#### Cropped area of land and cropping intensity

The net cropped area is the total cultivated area of the farmers, irrespective of the number of times the land was used to cultivate crops. It is the cultivable land of the farmers, which includes the leased in land for cultivation and excludes the cultivable land leased out by the farmers. Gross cropped area is the total area sown, even if it is sown more than once. The cropped areas are measured in acres. The table below presents the number of respondent farmers, net cropped area, and gross cropped area in both project and comparison region during baseline and MTR.

PoCRA, through its intervention, also aims to improve the cropping intensity in the project area. Cropping intensity is defined as gross cropped area divided by net sown area multiplied by hundred. The cropping intensity in the project area is 150 percent (as compared to 112 percent during baseline), and that in the comparison area is 146 percent (as compared to 114 percent during baseline). The DID (difference in differences between project and comparison) estimate for the cropping intensity implies that it has improved by 6 percent since baseline.

Table 10 Cropped area of land and cropping intensity

Particular	Baseline	MTR
Sample Size		
Project	1971	2133
Comparison	1999	2118
Net Cropped Area (in acres)		
Project	9576	8032
Comparison	10614	7815
Gross Cropped Area (in acres)		
Project	10742	12058
Comparison	12112	11429
Cropping Intensity		
Project	112	150
Comparison	114	146

### Season wise major crops cultivated

As part of the MTR survey, the farmers were asked about the crops they had grown on their land during different agriculture seasons in the last one year. It was found that soybean (project: 43%, comparison: 45%) and cotton (project: 28%, comparison: 27%) are the most widely grown crops in the Kharif season. These are followed by Pigeon-pea, Maize, Black gram, green gram, and Millets.

Table 11 Main crops grown in the Kharif season

Kharif Crops	Project (Valid N)	Comparison (Valid N)	Project (%)	Comparison (%)
Soybean	1287	1449	43	45
Cotton	824	880	28	27
Pigeon Pea	388	406	13	13
Maize	136	194	5	6
Black Gram	81	60	3	2
Green Gram	43	56	1	2
Millet	40	35	1	1
Turmeric	35	19	1	1
Sorghum-Kharif	20	30	1	1
Sugarcane	7	8	0	0
Other Kharif Crops	123	70	4	2
Total	2984	3207	100	100

In the Rabi season, the most widely grown crops among those who had sown crops in rabi season were found to be Chickpea (Project: 47%, Comparison: 48%) followed by Sorghum-Rabi (22 % in both Project and Comparison) and Wheat (Project: 21%, Comparison: 22%).

Table 12 Main crops grown in the Rabi season

Rabi Crops	Project (Valid N)	Comparison (Valid N)	Project (%)	Comparison (%)
Chickpea	700	701	47	48
Sorghum-Rabi	324	314	22	22
Wheat	321	321	21	22
Other Rabi Crops	160	123	11	8
Total	1505	1459	100	100

The cropping pattern during both Kharif and Rabi season matches with that observed during the baseline survey.

### Major crop wise area of land cultivated using irrigation

Crop wise percentage of land cultivated using irrigation for both Kharif and Rabi season was also analyzed, which is presented in the following table. In kharif crops, it was found that the highest percent of irrigated land is of Turmeric (96%), Black gram (64%), and Sugarcane (63%) in project area. They were followed by Cotton (55%), Sorghum (55%), Pigeon peas (54%) and Soybean (47). For Kharif crops in comparison area, similar trend was observed with Turmeric sees the highest area under irrigation (84%) followed by Sugarcane (79%), Maize (49%), Green gram, Pigeon pea, Cotton, and Soybean as evident in the table below.

Table 13 Percentage land under irrigation for main Kharif crops

Kharif Crops	Land Cultivated (acres)	Land Irrigated (acres)	Project (%)	Land Cultivated (acres)	Land Irrigated (acres)	Comparison (%)
Soybean	3700	1750	47	3991	1355	34
Cotton	1990	1095	55	2017	837	42
Pigeon Pea	669	360	54	624	261	42
Maize	226	111	49	308	151	49
Black Gram	155	99	64	92	29	32
Green Gram	55	24	44	56	24	43
Millet	65	27	42	51	20	39
Turmeric	56	54	96	25	21	84
Sorghum	31	17	55	43	8	19
Sugarcane	16	10	63	14	11	79
Other crops	191	140	73	104	55	53

During cultivation of rabi crops, percentage of land under irrigated land is higher as expected. Percent of cultivated land under both Chickpea and Sorghum being irrigated is higher (Project: 88%, Comparison: 71%).

Table 14 Percentage land under irrigation for main Rabi crops

Rabi Crops	Land Cultivated (acres)	Land Irrigated (acres)	Project (%)	Land Cultivated (acres)	Land Irrigated (acres)	Comparison (%)
Chickpea	1884	1659	88	1758	1252	71
Sorghum	680	597	88	621	434	70
Wheat	547	509	93	516	489	95
Other crops	273	264	97	212	184	87

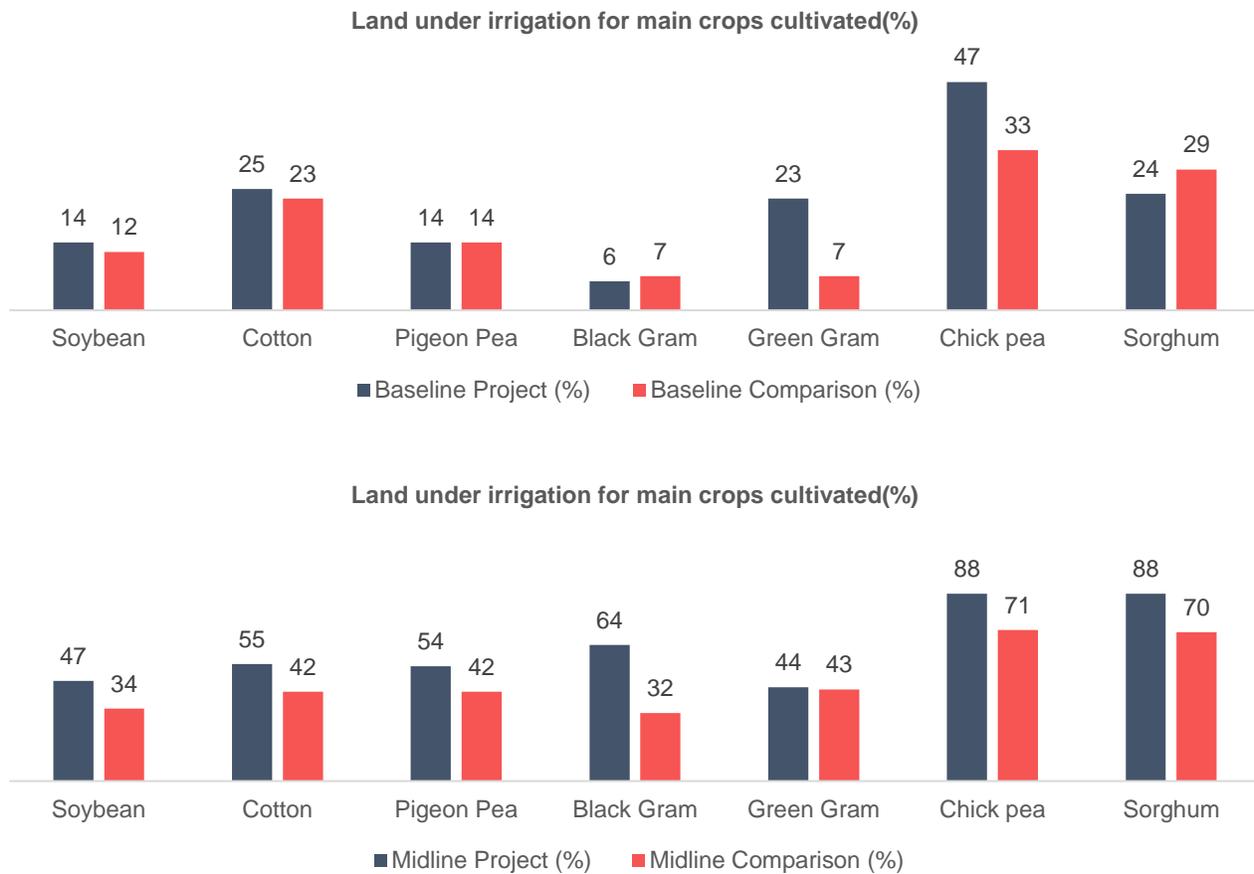


Figure 16 Land under Irrigation for main crops

### 3.2.4. Increase in Productivity of Major Crops

The productivity for the Soybean, Pigeon Pea, Cotton, Green gram, Black gram, Chickpea and Sorghum has been calculated as the ratio of gross production (in quintal) to cultivated land under that specific crop (in acres) and has been presented in the below table.

Table 15 Productivity (quintal per acre)

Crop	Mean Productivity (quintal/acre)*	Std. Err	95% Confidence Interval	
<b>Soybean</b>				
Project(n=1257)	5.83 (5.2)	0.10	5.6	6.0
Comparison (n=1424)	5.41 (5.4)	0.08	5.3	5.6
<b>Cotton</b>				
Project(n=811)	5.97 (4.2)	0.16	5.7	6.3
Comparison (n=864)	5.54 (4.6)	0.12	5.3	5.8

Crop	Mean Productivity (quintal/acre)*	Std. Err	95% Confidence Interval	
<b>Pigeon Pea</b>				
Project(n=379)	4.52 (4.1)	0.14	4.2	4.8
Comparison (n=401)	3.93 (4.3)	0.14	3.6	4.2
<b>Black gram</b>				
Project(n=83)	4.05 (1.5)	0.71	2.4	5.5
Comparison (n=58)	3 (2)	0.21	2.6	3.4
<b>Green gram</b>				
Project(n=43)	2.83 (1.6)	0.40	2.0	3.7
Comparison (n=55)	2.50 (1.7)	0.25	2.0	3.0
<b>Chickpea</b>				
Project(n=705)	4.82 (3.7)	0.10	4.6	5.0
Comparison (n=698)	4.36 (3.6)	0.09	4.2	4.5
<b>Sorghum</b>				
Project(n=338)	4.89 (2.3)	0.16	4.6	5.2
Comparison (n=338)	4.34 (2.7)	0.15	4.0	4.6

\* Values in bracket are for baseline

It is observed that the productivity of major crops is slightly more when compared to the estimates of baseline survey.

The below table presents the district-wise average productivity for the above crops. Average productivity has been presented separately for both project and comparison areas. Though it is to be noted that the district-wise productivity values are indicative as the sample is not powered to give district-wise statistical estimates.

Table 16 Productivity of crops (quintal/acre) in project area across districts

District	Soybean	Cotton	Pigeon pea	Black gram	Green gram	Sorghum	Chickpea
Aurangabad	6.21 (n=26)	6.89 (n=249)	3.50 (n=279)	0 (n=0)	1.85 (n=2)	4.77 (n=13)	4.29 (n=26)
Beed	5.46 (n=94)	5.18 (n=89)	4.92 (n=60)	3.52 (n=32)	3.31 (n=7)	4.67 (n=57)	5.27 (n=60)
Hingoli	5.33	5.58	4.39	2.96	2.88	4.03	6.09

District	Soybean	Cotton	Pigeon pea	Black gram	Green gram	Sorghum	Chickpea
	(n=157)	(n=40)	(n=41)	(n=5)	(n=2)	(n=9)	(n=74)
Jalna	5.67 (n=108)	5.67 (n=233)	3.44 (n=37)	5 (n=1)	3.02 (n=9)	4.45 (n=19)	4.47 (n=42)
Latur	6.43 (n=256)	5.30 (n=5)	4.93 (n=81)	0 (n=0)	1.69 (n=4)	5.68 (n=29)	4.48 (n=188)
Nanded	5.27 (n=177)	5.24 (n=79)	5.16 (n=33)	7.93 (n=12)	2.66 (n=5)	4.70 (n=21)	4.96 (n=111)
Osmanabad	6.12 (n=276)	0 (n=0)	4.64 (n=57)	3.36 (n=30)	22.33 (n=6)	5.14 (n=155)	4.51 (n=129)
Parbhani	5.79 (n=163)	5.90 (n=116)	4.27 (n=43)	2.87 (n=3)	3.50 (n=8)	4.21 (n=35)	4.83 (n=75)

On mapping the productivity of these main crops, we tried to gauge the spatial variability in their yield. Soybean farmers were very few in the Aurangabad district. For cotton, more farmers and higher yields were observed in Aurangabad, with very few farmers in the lower belt of Marathwada. Black gram was sown mostly in the lower belt of Marathwada, with Osmanabad, Latur, and Nanded accounting for most farmers. Green gram saw a spattering of farmers in all the districts, and Beed and Jalna showed low productivity. For the rabi crops of Chickpea and Sorghum, we again see a higher concentration of farmers in Osmanabad and Latur. This region also accounts for high productivity numbers.

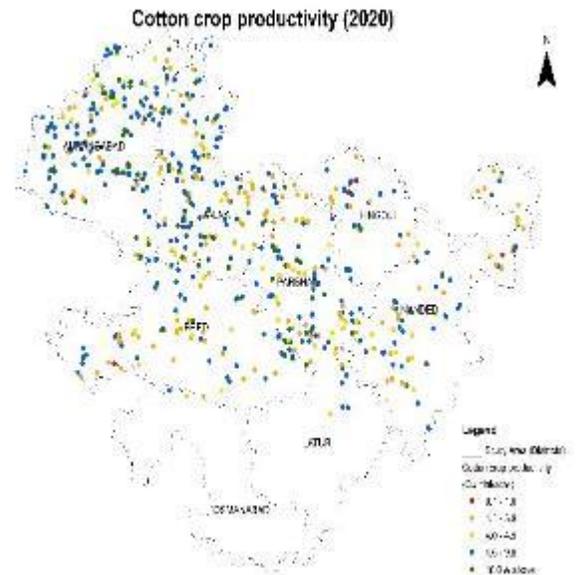
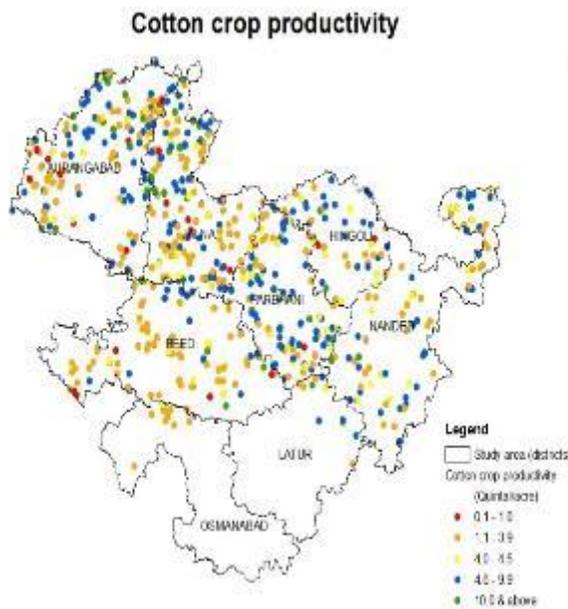
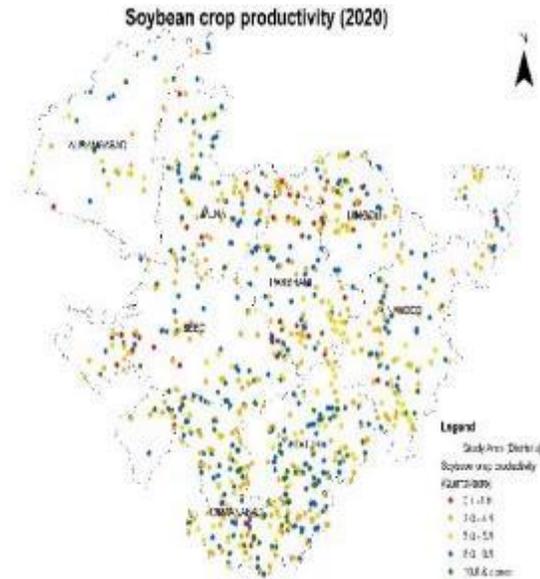
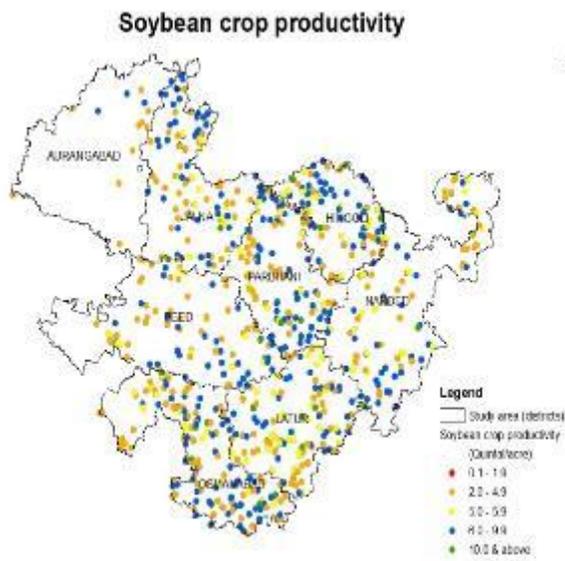
Table 17 Productivity of crops (quintal/acre) in comparison area across districts

District	Soybean	Cotton	Pigeon pea	Black gram	Green gram	Sorghum	Chickpea
Aurangabad	5.44 (n=36)	6.92 (n=252)	5.84 (n=30)	1 (n=1)	2.80 (n=5)	5.48 (n=12)	4.38 (n=36)
Beed	5.94 (n=149)	4.72 (n=113)	3.94 (n=56)	1.96 (n=12)	1.85 (n=10)	4.42 (n=63)	4.44 (n=75)
Hingoli	5.14 (n=162)	5.46 (n=36)	3.73 (n=46)	4.00 (n=1)	4.23 (n=4)	3.90 (n=4)	5.51 (n=67)
Jalna	5.53 (n=150)	5.27 (n=247)	3.66 (n=48)	2.00 (n=2)	3.11 (n=6)	3.83 (n=22)	4.61 (n=37)
Latur	5.48 (n=261)	5.83 (n=2)	3.65 (n=87)	2.00 (n=1)	2.22 (n=9)	4.36 (n=38)	4.13 (n=171)
Nanded	5.16 (n=183)	4.20 (n=87)	4.33 (n=46)	3.63 (n=15)	3.11 (n=13)	4.34 (n=31)	4.42 (n=91)

District	Soybean	Cotton	Pigeon pea	Black gram	Green gram	Sorghum	Chickpea
Osmanabad	5.79 (n=300)	4.00 (n=3)	3.90 (n=38)	3.16 (n=24)	0.75 (n=2)	4.67 (n=110)	4.36 (n=173)
Parbhani	4.63 (n=183)	5.03 (n=114)	3.36 (n=50)	4.50 (n=2)	1.25 (n=6)	3.62 (n=59)	3.59 (n=48)

**Baseline**

**Mid-term**



**Baseline**

**Mid-term**

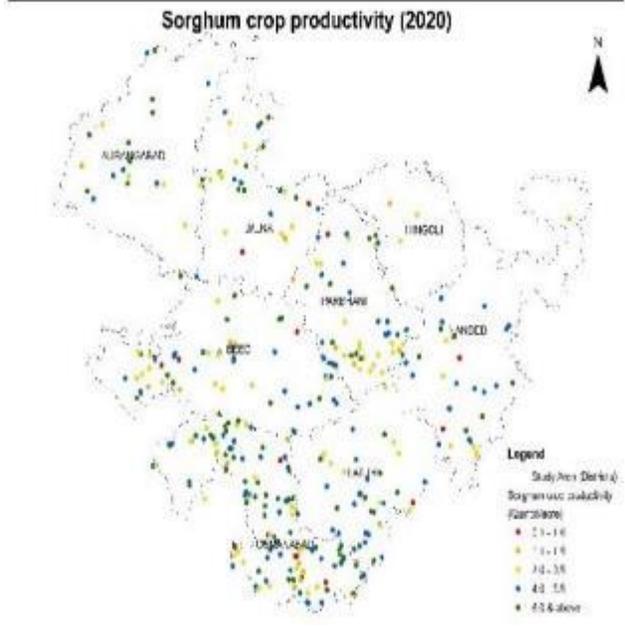
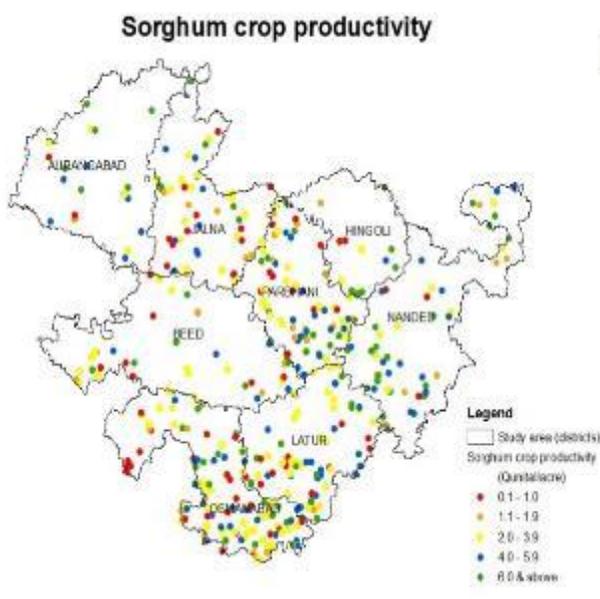
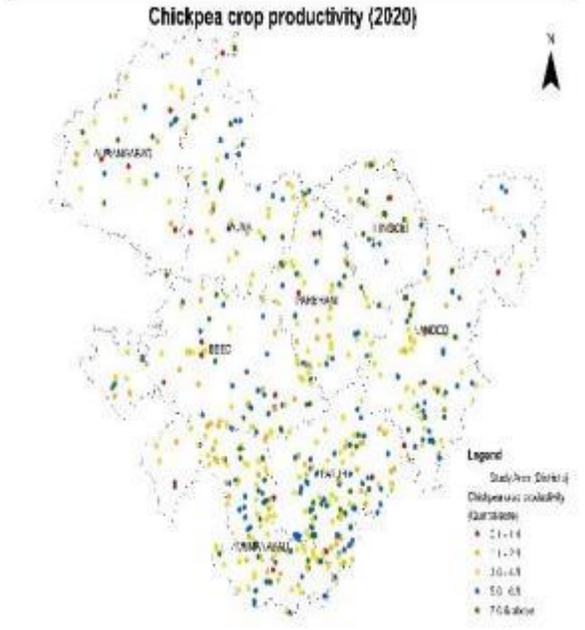
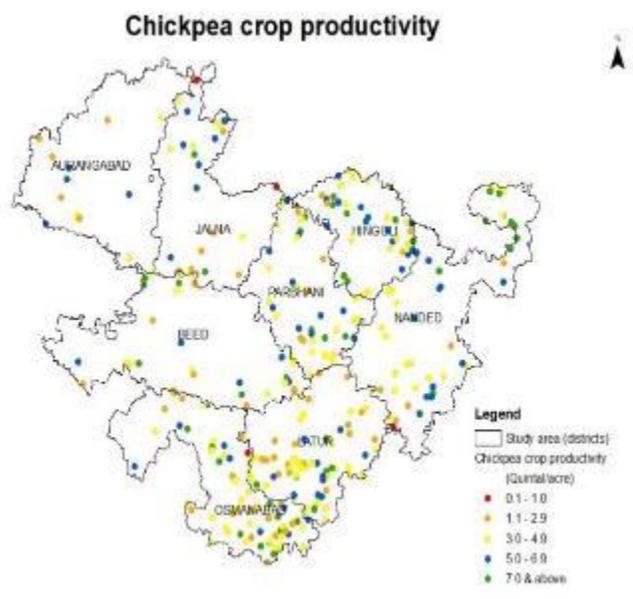


Figure 17 GIS map of productivity distribution of main crops

### 3.2.5. Cost of Cultivation

The MTR team conducted analysis of cost of cultivation and derived C2plus50 for main crops grown in the project area using the formula of MS Swaminathan Committee, constituted by the National Commission for Farmer. The method used for evaluation of Cost of Cultivation of crops as per the Directorate of Economics & statistics is shown below:

1. Cost A1: It includes all actual expenses in cash and kind in production by the farmer
  - a. Labour Charges (Hired + Family)
  - b. Bullock Labour charges (owned + rented)
  - c. Machinery Charges
  - d. Seed Cost
  - e. Insecticides /Pesticides
  - f. Fertilizers & Manure
  - g. Irrigation charges
  - h. Miscellaneous Expenses
2. Cost A2: Cost A1 + rent paid for leased land.
3. Cost B2: Cost A2+ rent value of owned land
4. Cost C2: Cost B2 +imputed value of family labour

As part of the MTR survey, the average per acre cost of cultivation under the key cost heads viz. cost of inputs, cost of labour and cost of marketing (which was further broken down) was enquired from the respondents. The cost of cultivation per acre has been calculated for the key crops namely cotton, pigeon pea, soybean, black gram, green gram, and chickpea. It is found that cost of irrigation is negligible for kharif crops, except for cotton which is water intensive.

From table 18, it is evident that the pulses namely, Chickpea, Black gram, and Green gram give better return to the farmers over C2plus50 as compared to Cotton and Soybean. The Black Gram and Green Gram have better water productivity as compared to Cotton. Soybean was found to have the highest water productivity but has negligible returns. As the project area is drought prone and crops are frequently exposed to climate shocks, availability of drought tolerant and climate resilient varieties of selected crops is critical for the farmers. It was found that early maturing and drought-tolerant cultivars of green gram (BM 2002-1), chickpea (BDN 708 and BDN 711) and pigeon pea provided 20-25 per cent higher yield than the indigenous cultivars in Marathwada.

It is recommended to promote Pulses (Black gram, Green gram, Pigeon pea and Chickpea) together with Soybean in the project area, while discouraging the farmers to grow cotton. Soybean cultivation should be promoted selectively while assessing the market demand and supply in different years. It is also recommended to promote these crops in inter-cropping and agroforestry system. As inter-crops, these crops can be grown together with vegetables (chilli, onion, okra, capsicum) where water is available or with medicinal and aromatic plants like turmeric and ginger. As agroforestry, these crops can be grown together with Papaya, Guava, Custard Apple and Citrus. The recommendations for promoting Pulses and those crops which require less water are in line with the Govt of Maharashtra, and Government of India strategy to encourage farmers shift to larger area under these crops and adopt best technologies and farm practices, to correct demand - supply imbalance in pulses<sup>8</sup>.

<sup>8</sup> <https://pib.gov.in/PressReleasePage.aspx?PRID=1725612>

Figure 18 Average cost of cultivation under main cost heads for key crops

Midterm	Cotton	Pigeon pea	Soybean	Blackgram	Greengram	Chickpea
Sample N	811	379	1257	83	43	705
<b>Key heads -Cost of Cultivation</b>						
Labour (INR/acre) - Hired and family labour	3168	2165	2468	1593	1488	1772
Bullock labour charges (INR/acre) - owned & hired	600	595	282	250	336	178
Rent of machinery (INR/acre)	1716	1933	1687	1349	1449	1500
Seeds (INR/acre)	1769	958	2267	985	661	1547
Insecticides and Pesticides (INR/acre)	2704	2139	1859	1196	1180	1434
Manures and Fertilizers (INR/acre)	3812	2128	2219	1400	1357	1529
Irrigation (INR/acre)	178	63	31	6	85	88
Miscellaneous (Transportation, Insurance, etc) (INR/acre)	986	934	1146	660	304	736
<b>Cost of Cultivation (Rs./acre)</b>	<b>14932</b>	<b>10915</b>	<b>11959</b>	<b>7438</b>	<b>6860</b>	<b>8785</b>
<b>Rental value of land (Rs./acre)**</b>	<b>5053</b>	<b>6813</b>	<b>3451</b>	<b>2110</b>	<b>1342</b>	<b>2428</b>
<b>Total Cost of Cultivation (Rs/acre)</b>	<b>19985</b>	<b>17728</b>	<b>15410</b>	<b>9548</b>	<b>8202</b>	<b>11213</b>
<b>Yield (quintal/acre)</b>	<b>5.97</b>	<b>4.52</b>	<b>5.83</b>	<b>4.05</b>	<b>2.83</b>	<b>4.82</b>
<b>C2 (Cost of Production including family labour and land rental value) (Rs./quintal)</b>	<b>3348</b>	<b>3922</b>	<b>2643</b>	<b>2357</b>	<b>2898</b>	<b>2326</b>
<b>C2 plus 50 in Project Area (Rs./quintal)</b>	<b>5021</b>	<b>5883</b>	<b>3965</b>	<b>3536</b>	<b>4348</b>	<b>3490</b>
<b>MSP Declared by Govt (2021-22)</b> ( <a href="https://farmer.gov.in/mspstatements.aspx">https://farmer.gov.in/mspstatements.aspx</a> )	<b>5726</b>	<b>6300</b>	<b>3950</b>	<b>6300</b>	<b>7275</b>	<b>5230</b>
<b>Margin to Farmers over MSP</b>	<b>705</b>	<b>417</b>	<b>-15</b>	<b>2764</b>	<b>2927</b>	<b>1740</b>
<b>Percentage</b>	<b>14</b>	<b>7</b>	<b>0</b>	<b>78</b>	<b>67</b>	<b>50</b>

MSP Declared by Govt (2021-22) (<https://pib.gov.in/PressReleasePage.aspx?PRID=1725612>)

Reference: Department of Agriculture Economics, Dr. PDKV, Akola, 2019-2020

In addition to growing crops for consumption and selling, a few farmers are also engaged in seed production, though on a very small scale. Only about 0.38% (8 out of 2128) farmers from project area and 0.24% (5 out of 2124) farmers from comparison area reported being engaged in seed production. As part of the MTR survey, response of farmers on availability of machine/tools on rent was enquired. It was observed that a fairly high (Project: 75% and Comparison:74%) percentage of farmers were able to use/rent farm machinery when they required it. When asked about availability of agriculture related skilled labor in their area, 74% from project area and 71% from comparison area said that skilled labor was available for work when they needed them.

### 3.2.6. Increased Adoption of Orchards and Farm Periphery Plantation

Of the total cultivable land, nearly 7% (146 of 2128) in the project area and 3% (67 of 2124) in the comparison area were under orchard plantation. 134 respondent farmers in the project (a total of 266 and 63 (141 acres) in comparison were engaged in orchard plantation with a mean area of 2 acres under it. Nearly 42 percent (893 out of 2128) of respondent farmers in both project and 40 percent (858 of 2124) comparison areas reported of growing trees on the periphery of their agricultural lands. The most widely grown tree is neem, followed by mango and babul, ber and tamarind.

During MTR, the respondents were also enquired if they have completed fencing in the farm or not. As compared to the baseline figure of 1.8 percent, 3 percent of farmers had completed the fencing. In the comparison area, while 2.2 percent of respondents had fencing during the baseline, it was reduced to 1.2 percent. Though the respondents having fencing are low, the comparatively high percentage in MTR against baseline and comparison area indicate the effect of the project interventions.

### 3.2.7. Progressing towards Protected Farming

The MTR survey also aimed to enquire about the extent to which protected farming practices like shade-net, poly house, or polytunnel are currently adopted. From the sample of surveyed farmers, 22 (as compared to 8 in the baseline) reported using shade-net in the project area covering a total of nearly 15 acres of cultivable land. Nineteen (19) farmers reported growing vegetables, and three (3) reported of developing nurseries in shade net farming. None reported using shade-net in the comparison area. Similarly, while five (as compared to one in the baseline) reported applying for poly house for cultivation, none in the comparison areas was engaged in poly house cultivation. Only one farmer reported applying for poly tunnel in the project area. This shows that though the farmers in project areas have started adopting the protected farming technologies, its penetration is still very low in the Marathwada region in both project and comparison areas.

#### Mulching Practices

The respondents were also enquired about the mulching practices being followed on the farm. As against the baseline figure of 2 percent in project and comparison areas, 14.85 percent in the project area and 13.51 percent in comparison area were using mulching practice when MTR was conducted.

Table 18 Type of Mulching used by respondents (in Percentage)

S. No.	Type of Mulching	Project (%)	Comparison (%)
1	Vegetative	13.16	12.61
2	Polythene sheet	1.36	0.71
3	Both	0.33	0.19
4	None	85.15	86.49

### 3.2.8. Reduced Pest/ Disease Attack through Integrated Pest Management Practices

Pests' attacks are a major issue for agriculture in the Marathwada region, with most pests attacking cotton and soybean crops. The MTR survey team asked the farmers about pest management in their fields and their practices and awareness related to pest management.

Jeevamrut, Beejamrut, and neem extract are made from natural ingredients by farmers. The survey team asked the farmers if they prepared these solutions on their farms. It was found that only 5.5% of the farmers in the project and 6.1% in comparison areas have reported that they prepare Jeevamrut/ Beejamrut/ Neem extract solution for application on their land. Another method of mitigating pest attacks is the introduction of natural enemies of pests like spiders, ladybirds, and other insects in the crop. The survey team enquired the farmers about the awareness of the different natural enemies to pests. The findings revealed that

awareness was low with most responses for spider, parasitic wasp and dragonfly. Nearly 50 % of respondents in both the project and comparison arm were not aware of any natural enemies to the pests.

Besides natural remedies, the farmers were asked about their use of pesticides. About 81% of farmers in the project and 84% in the comparison area acknowledged using pesticides in their fields. The chemical pesticides are highly toxic, and safety measures must be taken before, during, and after their use. The farmers who acknowledged using pesticides were further enquired about the safety measures they adopt while spraying pesticides on the field. The most common safety measures adopted by the farmers are to cover their eyes and nose while spraying (Project = 78%, Comparison = 79%), wear gloves while spraying (Project = 70%, Comparison = 71%), and take a bath after spraying pesticides in the field (Project = 88%, Comparison = 87%). As compared to baseline observations, the percentage of farmers who reported of disposing the pesticide bottle safely after use has improved. Following methods are adopted for disposal of pesticides containers – triple rinse container (Project = 46%, Comparison = 47%), puncture /collection for safe disposal (Project = 59%, Comparison = 61%), and did not reuse (Project = 81%, Comparison = 80%)

To understand the extent to which the crops of the farmers were affected by pests, farmers were asked if their crops were affected by any pest or disease in the last 12 months. As compared to the baseline observations, the percentage of farmers affected by pests has reduced in MTR. It is observed that 64% (as compared to 84% in the baseline) farmers in the project area and 65% (as compared to 89% in baseline) of farmers in the comparison area reported their crop being affected by pests or diseases in the last 12 months.

The farmers who said that they had been affected by pests and diseases were further asked to specify the main pests and diseases which affected these crops. The crops most affected by pests and diseases are soybean (Project: 41%; Comparison: 41 %), cotton (Project: 37%; Comparison: 41%) and Pigeon pea (Project: 12%; Comparison: 12%). Nearly 73% of farmers in both project and comparison were aware that the pesticides they are using as a measure to control pests were not banned or restricted for use.

Table 19 Distribution of crops affected by pest/ diseases (Percentage)

S. No	Crop	Baseline		MTR	
		Project	Comparison	Project	Comparison
		N = 1649	N = 1772	N = 1361	N = 1388
1	Soybean	63.01	65.63	63.78	68.88
2	Cotton	50.03	48.53	37.84	41.86
3	Sorghum	27.11	27.09	16.9	17.15
4	Pigeon pea	26.08	28.27	19.84	20.1
5	Chickpea	18.56	20.99	33.8	32.71
6	Green gram	13.04	14.56	2.13	2.81
7	Maize	9.34	14.28	6.47	10.52
8	Millet	8.55	7.51	2.13	1.22
9	Black gram	8.13	8.24	4.04	2.88
10	Wheat	6.73	6.94	15.28	14.12

S. No	Crop	Baseline		MTR	
		Project	Comparison	Project	Comparison
		N = 1649	N = 1772	N = 1361	N = 1388
11	Sugarcane	6.37	6.77	6.98	4.97
12	Turmeric	2.85	1.98	2.65	1.08
13	Onion	2.55	3.1	4.48	2.16
14	Groundnut	2	2.14	1.4	0.94
15	Sweet lime	0.79	0.17	1.98	0.72

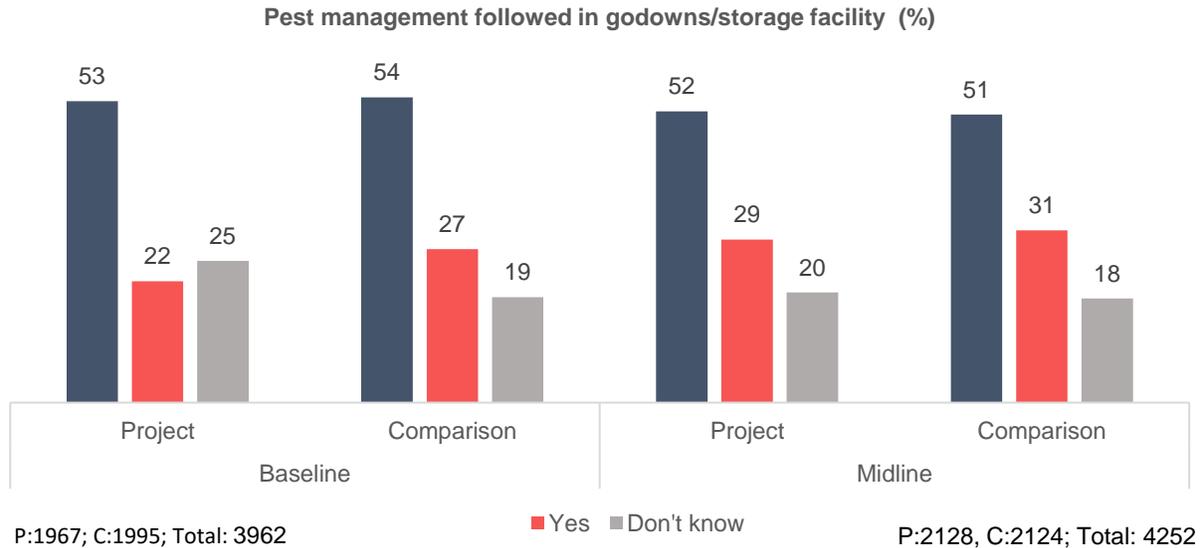
Table 20 Main Pests of the Major Crops

Crop (season)	Disease/ pest	Project	Comparison	Measures adopted
Cotton (Kharif)	Bollworm	89 (93) %	90 (95) %	Pesticide + Fungicides
	Aphids	23 (40) %	25 (44) %	
	Jassids	21 (32) %	23 (35) %	
Soybean (Kharif)	Caterpillar	42 (60) %	42 (55) %	Pesticides + Fungicides+ Weedicides
	Podborer	35 (54) %	35 (56) %	
	Aphids	16 (33) %	19 (34) %	
Pigeon Pea (Kharif)	Caterpillar	55 (61) %	54 (56) %	Pesticides
	Podborer	38 (61) %	31 (62) %	
	Leaf webber	21 (41) %	14 (43) %	
Sorghum (Kharif + Rabi)	Caterpillar	22 (61) %	14 (54) %	Pesticides
	Aphids	21 (39) %	20 (44) %	
Chickpea (Rabi)	Caterpillar	57 (66) %	52 (61) %	Pesticides
	Podborer	20 (61) %	17 (57) %	
	Leaf webber	9 (41) %	7 (42) %	

(\*Values in brackets are of baseline)

Apart from the field, another important site where pests destroy the harvest is at godowns/storage. We asked the farmers if pest management was followed in the godowns or storage facilities they use. As presented in the below graph, most of the farmers did not know or said that no pest control measures were

taken. Only 29% in project and 31% in comparison (which has improved marginally since baseline) said that measures for managing pests were employed at the godown.



*Figure 19 Pest management in godowns/ storage facility*

### 3.2.9. Improvement in Integrated Nutrient Management Practices

In addition to pest management, nutrient management is essential for improved crop productivity and reducing diseases in the crops. Soil testing is very important for understanding the nutrient composition and for nutrient management of the soil. The awareness of soil-testing was found to have improved since the baseline survey but remains low, with 33% (as compared to 28% in the baseline) from the project and 30% (as compared to 25% in the baseline) from the comparison saying they knew about it. Of the respondents who were aware of soil testing, 93% in the project and 96% in the comparison arm had never gotten soil testing in their fields. Out of the respondents aware of soil testing, 5% in the project arm and 3% in the comparison arm reported of getting soil testing done but did not have their cards available with them. Only 2% of respondents in the project and 1% of respondents in the comparison arm acknowledged getting soil testing done and having their soil health card available with them.

Another way of ensuring the quality of soil is through intercropping, where complementary crops are sown alongside. The practice of intercropping is not that widespread. Only 8% in the project area and 11% in the comparison area reported that they have ever practiced it. The most popular combination of crops for intercropping is soybean and pigeon pea (Project: 49%; Comparison: 52%), followed by cotton and pigeon pea (Project: 37%; Comparison: 26%).

The MTR survey team also asked the farmers how they deal with crop residue after harvesting the crops. The most common method followed is burning of the residue in the field (Project: 68%; Comparison: 67%), followed by using it as animal feed (Project: 44%; Comparison: 46%). Only 9% of farmers in the project and 7% in comparison areas use the remaining stubble as mulching for their fields.

### 3.2.10. Increase in Agricultural Technology Training and Adoption

As part of the MTR study, the status of training and adoption of different climate resilient agriculture technologies were assessed. As evident from the below table, though the percentage of respondent farmers participating in the training of CRATs in project areas is better than the comparison, the adoption is still low. The technologies related to preparation and cultivation, such as using improved seed varieties, land preparation, use of machinery, and intercropping, showed better adoption than others. The adoption trends were observed to be similar across both project and comparison areas.

Table 21 Adoption of technology across project and comparison study area

Agricultural technology	Baseline				MTR				
	Project		Comparison		Project		Comparison		
	Valid N = 1965	%	Valid N = 1995	%	Valid N = 2142	%	Valid N = 2130	%	
a	Contour cultivation	215	11.1	228	11.8	603	28.15	447	20.99
b	BBF	68	3.5	61	3.2	382	17.84	282	13.24
c	Intercropping	412	21.3	444	22.9	576	26.89	486	22.82
d	Improved seed	600	31.2	593	30.2	875	40.85	845	39.67
e	Seed treatment	165	8.5	194	9.9	319	14.89	225	10.56
f	INM	231	11.9	234	12.1	379	17.69	327	15.35
g	IPM	316	16.4	356	18.3	492	22.97	415	19.52
h	Furrow opening	64	3.4	64	3.3	278	12.98	198	9.3
i	Foliar spray	366	18.9	307	15.4	868	40.52	746	35.02
j	Farm pond	43	2.2	44	2.3	163	7.61	126	5.92
k	Conservation tillage	138	7.2	165	8.4	372	17.37	309	14.51
l	Biomass	57	2.9	81	4.2	130	6.07	118	5.54
m	Mulching	63	3.2	52	2.6	165	7.7	99	4.65
n	Citrus on broad ridges	33	1.7	39	2	142	6.63	87	4.08
o	Canopy management	28	1.5	23	1.2	135	6.3	95	4.46
p	Shade net	16	0.9	4	0.2	108	5.04	72	3.38
q	Polyhouse	7	0.4	6	0.3	96	4.48	79	3.71
r	Polytunnel	6	0.4	1	0.1	78	3.64	70	3.29
s	Rainwater harvesting	131	5.5	104	4.2	213	8.84	163	6.76
t	Small livestock	79	3.3	79	3.3	163	6.76	152	6.31
u	Poultry	47	2	43	1.8	91	3.78	86	3.57
v	Sericulture	14	0.6	8	0.3	103	4.27	71	2.95
w	Apiculture	6	0.2	3	0.1	85	3.53	71	2.95
x	Inland fisheries	12	0.7	8	0.5	67	3.13	59	2.77
y	Land preparation	538	28	554	28.3	987	46.08	920	43.19
z	Machinery	571	29.6	514	26	980	45.75	890	41.78

### 3.2.11. Ease of Access to Credit

As part of the MTR survey, the access to credit of the respondents was accessed. Access to credit is important for farmers so that they are able to sustain their livelihoods. This is because agriculture is input-intensive and returns from selling harvest take time.

The survey team asked the respondents if they had availed of any loans or credit after project initiation (June 2018). As can be seen in the figure below, access to credit has improved in project areas by 2%, while it has reduced by 3% in comparison areas when compared with baseline estimates.

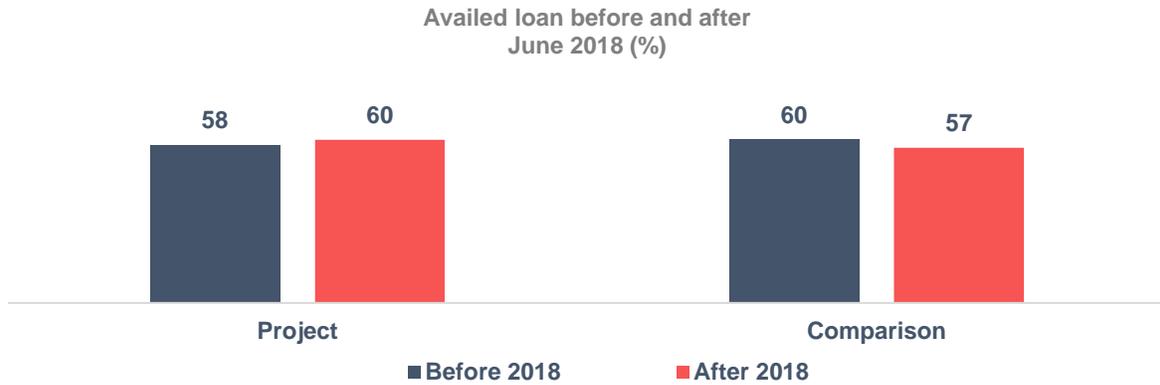


Figure 20 Availed loan before and after June 2018

The sources of the loan were then asked of the respondents. Majorly, commercial banks are the source of credit for farmers, with 81% in project and 84% in comparison areas choosing this option. Informal sources, micro-finance institutions, and self-help groups saw very low proportions both during baseline and MTR.

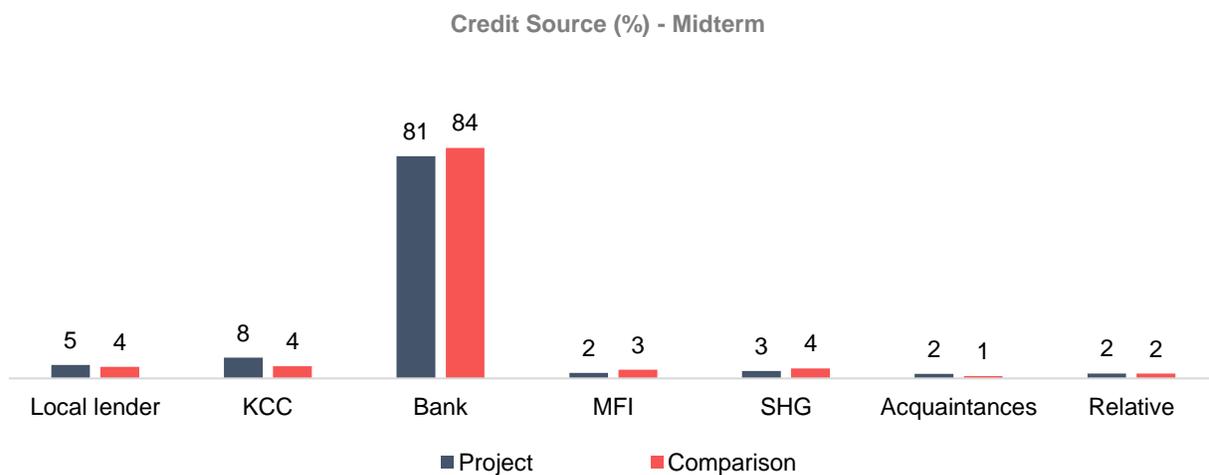
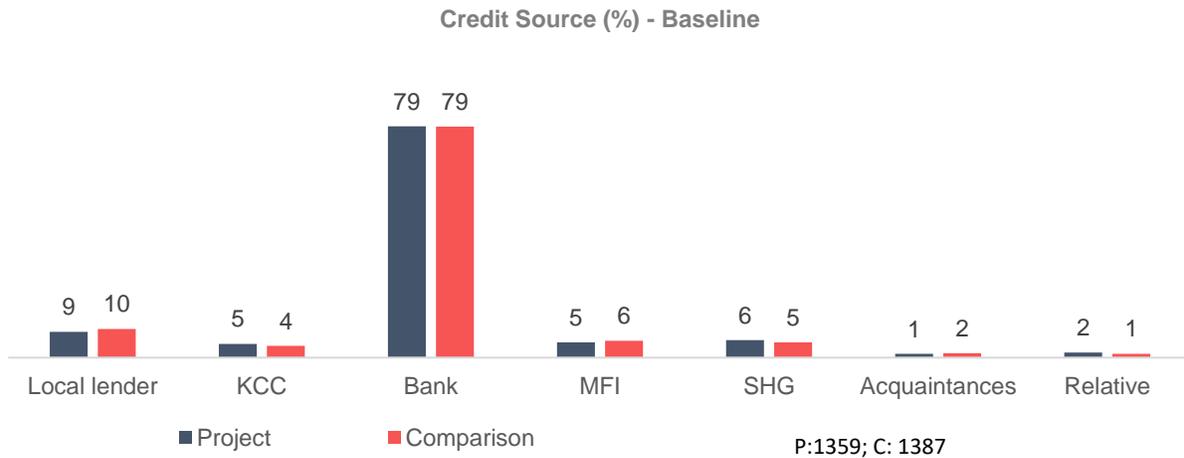


Figure 21 Sources of credit for respondents

The major reason for availing credit by the respondents was agriculture, with the proportion being same across the two study areas (Project: 86%; Comparison: 86%). Though credit requirement for agriculture has reduced by 3 % in both project and comparison, there is increase in need for credit in agriculture based allied activities. In project areas, credit requirement for the same has increased by 7 % and in comparison, areas the increase is 2%. Demand for credit has also increased for business by 3% in both project and comparison areas. Health and Education are other sectors we observed increased access to credit by nearly 4% when compared to baseline.

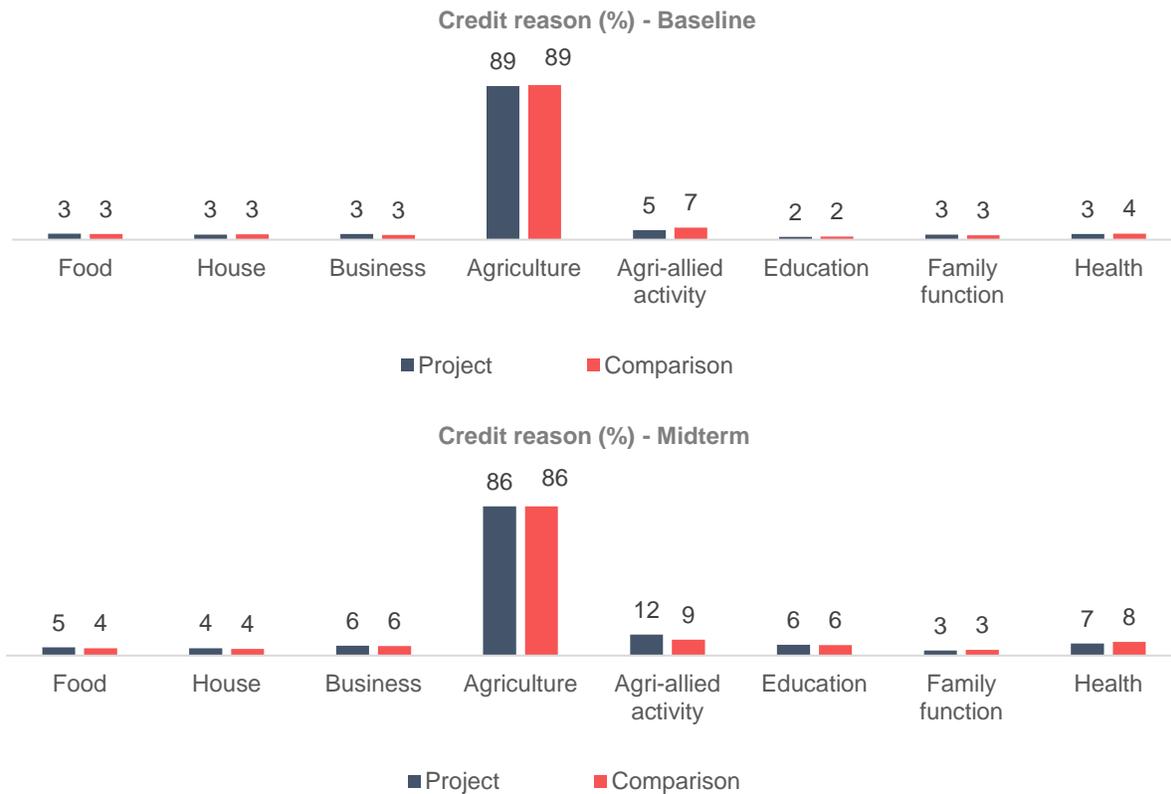


Figure 22 Reason for availing credit

As presented in below figure, across project and comparison areas, 24% in project and 25% in comparison reported of facing issues in availing farm loan. These problems were mainly due to the amount of paperwork and the repeated number of visits required for loan sanctions.

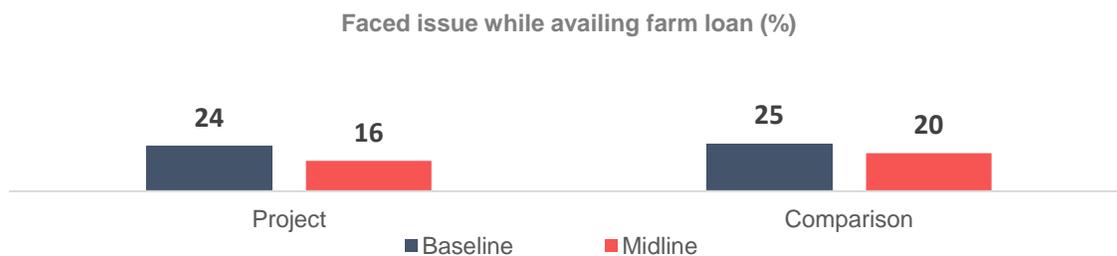


Figure 23 Percent of farmers facing issue in availing farm loan

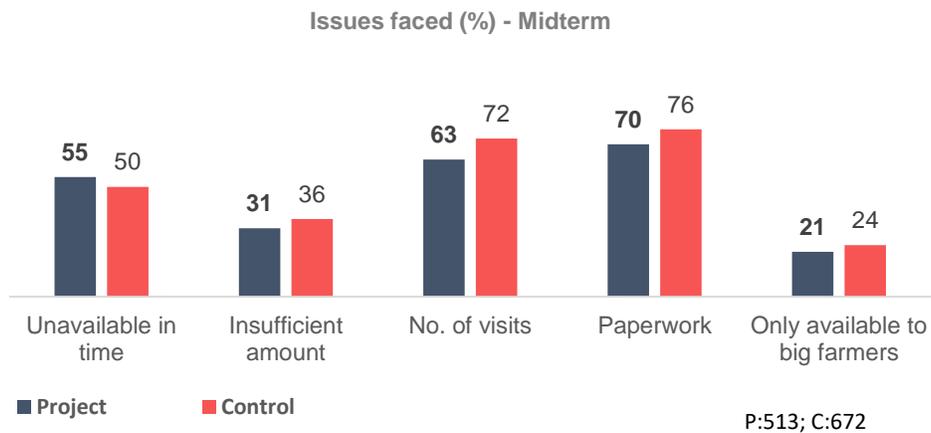
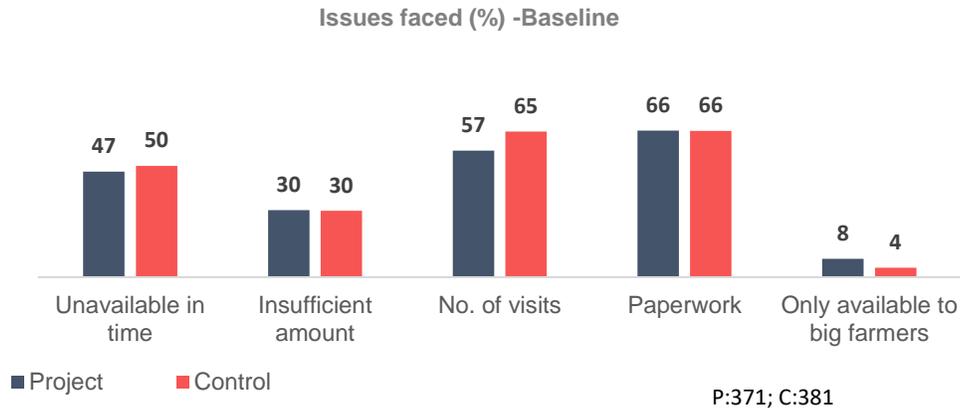


Figure 24 Issues faced while applying for farm loans

### 3.2.12. Increase in Access to Crop Insurance

Crop insurance is essential for reducing the vulnerability of farmers, mitigating their losses from pest or disease attacks on their crops, and weather-related damage. 51% from the project area and 52% from the comparison area had reported getting insurance for their crops. The main crop for which crop insurance was taken is soybean (Project: 73%; Comparison: 73%), followed by cotton (Project: 26%; Comparison: 31%).

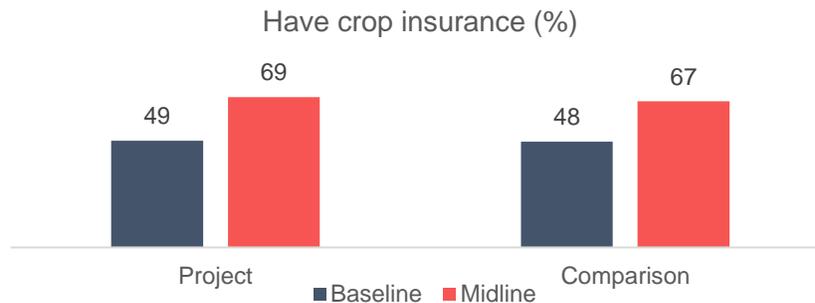


Figure 25 Percent of farmers who availed crop insurance

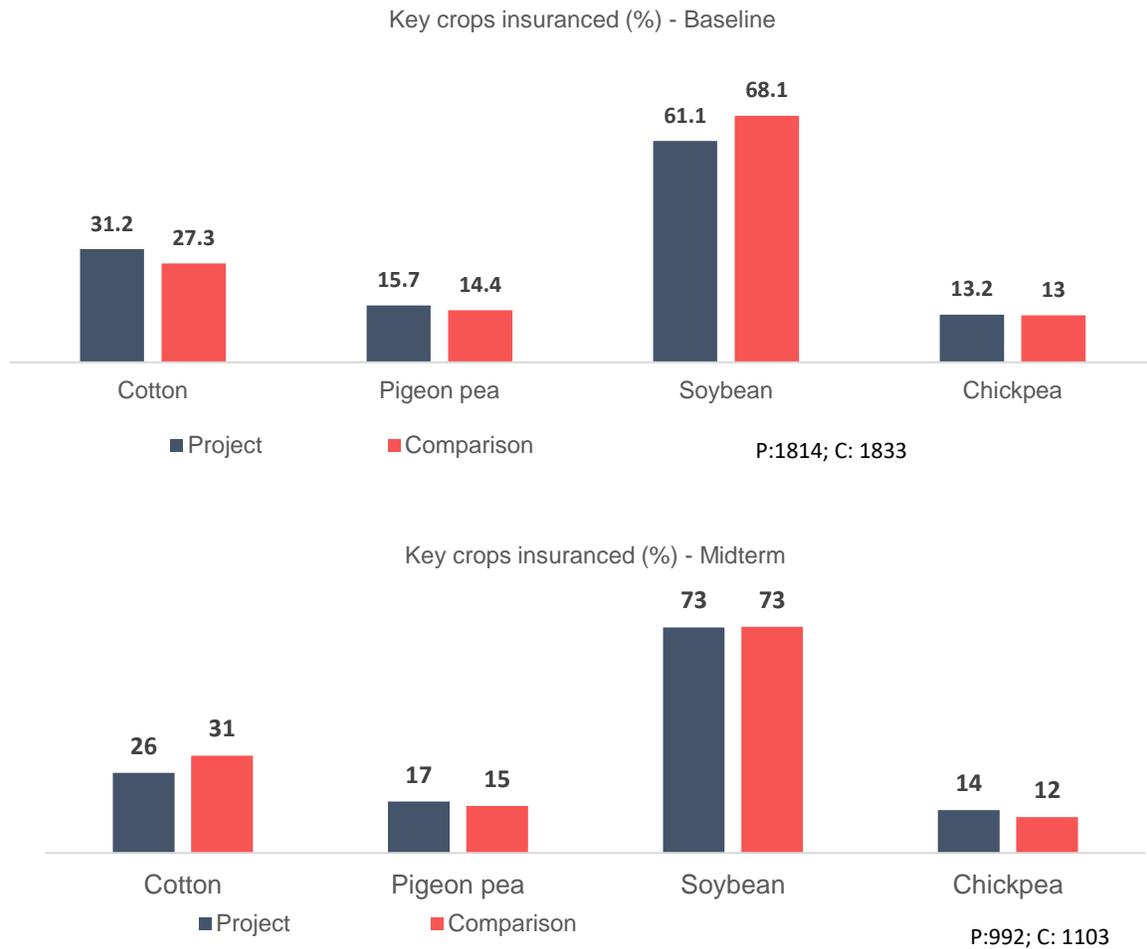


Figure 26 Percent of farmers who availed crop insurance

### 3.2.13. FFS Demonstration: Benefits and Challenges

It was found that the critical thinking, experimentation, and innovation skills of fellow farmers have improved. The farmers started questioning previous assumptions or cultural beliefs and reflected critically on the results of their own observations and experimentation. For example, the farmers placed greater reliance on their empirical field observations of crop performance than on following the advice of village elders. It was also found that the farmers are changing their attitude towards conserving water and soil. The FFS helped farmers to gain confidence in their farming activities. They became more motivated and proactive in their planning. Before the FFS, people's mindset was reportedly more passive. They had lower self-esteem and confidence, with a strong attachment to traditional beliefs and practices. The farmers related these positive attributes to a greater sense of work ethic and initiative-taking. All the farmers who followed FFS gained more confidence, demonstrated through interactions with others, including the outsiders. The farmers reported that they experience a reduced shyness after the FFS, with a better ability to express themselves.

The FFS leads to better knowledge about natural resources management. For example, the FFS farmers' insect-pest management decisions are based on field analysis and personal observations. The majority of the farmers observed and monitored their farms more closely after the FFS, making management decisions based on field observations. The farming practices, particularly agronomic practices, fertilizer application,

soil fertility/conservation, water conservation practices have improved because of their involvement in the FFS.

Nineteen (19) FFS beneficiaries were interviewed in project areas. Seven of them attend FFS for training on Cotton, six on Soybean, and the rest each for Maize, Chickpea, and Onion. The benefits reported from FFS training are listed in the table below.

Table 22 Benefits from PoCRA FFS

PoCRA FFS benefits reported (Multiple Responses)	Valid N	%
Awareness about good agriculture practices	12	63.16
Better awareness of the use of inputs (fertilizers, seeds etc)	9	47.37
Improvement in Soil health	8	42.11
Soil moisture was conserved around the crop roots	7	36.84
Fewer diseases in crops/Improved management of pest	8	42.11
Better water management for agriculture	9	47.37
Increase in crop production or yield	6	31.58
Saving on seed input cost	3	15.79
Saving on fertilizer input cost	4	21.05
Overall reduction in the cost of production	3	15.79
Better management of post-harvest crop residue	1	5.26
Total	19	100

Regarding the challenges, the majority of the farmers informed that they were not aware of the FFS sessions being conducted (40.1%), while many others were not aware of the timings (18.3%). Only less than 5% found the sessions not useful.

Table 23 Challenges in attending PoCRA FFS

Reason for not attending PoCRA FFS training	Valid N	%
Not aware about FFS sessions conducted	399	40.1
Do not find the FFS sessions useful	48	4.82
Due to personal work	142	14.27
Due to work in own field	164	16.48
Was not aware about timings	182	18.29
Found the new technology difficult to understand	18	1.81
Total	953	100

### 3.2.14. Coping with Climate Vulnerability and Management

As the objective of the PoCRA project is to reduce the climate vulnerability of its target beneficiaries, the respondents were asked if they have faced any climate vulnerability, like less rainfall, high temperature, dry spell, unseasonal rainfall in the last one year. The climatic shocks affect not just the farmers but every person's livelihood. Nearly 54% (which has reduced by about 19% since baseline) of the respondents across the study area reported that they have been affected by climate vulnerability in the past one year.

It is observed that drought (Project: 28%; Comparison: 26%), flood (Project: 41%; Comparison: 40%), untimely rains (Project: 52%; Comparison: 51%), extreme temperature (Project: 28%; comparison: 25%), pest attacks (Project: 45%; comparison: 47%) and crop diseases (Project: 50%; comparison: 52%) were key climatic vulnerabilities experienced most by the farmers in our study area.

Table 24 Climatic Vulnerabilities Experienced in Project and Comparison Area

Climatic vulnerabilities experienced	Project (%)	Comparison (%)
Drought	28	26
Flood	41	40
Untimely Rains	52	51
Extreme Temperature	28	25
Pests Attack	45	47
Diseases	45	47

The respondents who were practicing farming and who claimed to have experienced any climatic shock were then asked about the technology adopted by them to deal with the situation. The perceived technology reported the most helpful to tackle climatic vulnerability was found to be the use of improved seed varieties (Project: 59%; Comparison: 62%).

To understand the penetration of digital platforms (mobile and web use) related to agriculture, the respondents were asked if they used mobile applications and online websites related to agriculture after June 2018. Approximately 13% (a marginal increase of 2% since baseline) of the sample in the project and 11 % in comparison study areas had used mobile applications or websites to access agriculture-related information.

When further enquired about the type of digital solution used, it was found that the applications and websites mainly used by the respondents are mKisan, MSAMB app, and Krushi King. mKisan is used the most, with 54% in project areas and 61% in comparison areas saying they use this application.

The survey team also enquired about other technological sources of information used by the respondents for information on agriculture after June 2018. It was found that the Television (Project: 64%; Comparison: 64%), E-Seva (Project: 29%; Comparison: 24%), Newspaper (Project: 26%; Comparison: 23%) and SMS on phones (Project: 26%; Comparison: 24%) seemed to be the frequently used sources of information.

Apart from their own use of sources of information on agriculture, the respondents were also asked if they received advisories on climate or agriculture after June 2018. It was observed that an equal proportion of respondents (nearly 92%) had received such advisories compared to those who did not receive them, and this was the same for both project and comparison areas.

For those who said they had received advisory on climate and agriculture, the survey team further asked about the type of advisory they had received. Majority of respondents had taken advisory on crop pricing (Project: 73%; Comparison: 68%) followed by pest and diseases (Project: 45%; Comparison: 45%), weather forecast (Project: 70%; Comparison: 69%) and crop planning (Project: 54%; Comparison: 44%).

## Feedback from Farmers

As mentioned above in the methodology section, feedback from the key project stakeholders, including farmers (separate for farmers having landholding less than 2 Ha and for farmers having landholding more than 2 Ha) as well as Gram Panchayat representatives were taken to assess the project performance in the Marathwada region. Along with these qualitative interviews, field observations were also undertaken by experts and research team members to assess the ground-level situation. The main crops that were reported to be cultivated in the Kharif season in the project area were soybean, cotton, pigeon pea, black gram, green gram, and maize. The crops most reported to be cultivated in the rabi season were wheat, jowar, and chickpea. The key crops reported to be grown in the summer/Zaid season are groundnut and onion. The annual crops mostly cultivated were reported to be sugarcane and turmeric.

When asked about which cultivation season is perceived to be risky, the majority of the farmers perceived all cultivation seasons to be risky throughout the year due to water availability. Summer season is perceived to be the riskiest due to the unavailability of water and lack of irrigation.

Many farmers reported that the farming in the rabi season is mainly done by rainfed agriculture, and they face problems, particularly when the dry spell occurs. The irrigation is mainly done for the Rabi and the summer crops. Irrigation availability was reported to be low by all stakeholders during baseline, which significantly improved during the project period. Still, most of the farmers are dependent on rainfall. Dug wells and bore wells were reported to be the most commonly available sources of irrigation.

For seeds, the most popular brand and trusted for the crops was reported to be Mahabeej by almost all the farmers. It was followed by Ankur and Rashi seeds

The most common pest was found to be bollworm, pink worm as well as the army worm in the villages. Some farmers also complain about the fungus on the onion crop, which causes a decrease in production. The crop-wise major diseases are

- Soybean- Pod borer, Stem Borer, Green worm, Semi looper, and army worm
- Cotton- pink bollworm, leaf reddening, Pod borer, army worm
- Pigeon pea, Green Gram, and black grams- Aphids and Pod borer.

The general practice adopted to manage pests is spraying. Farmers mostly purchase pesticides based on the suggestions of agri-input dealers and, in a few cases, also based on suggestions of agriculture officers and Krishi Mitras.

The farmers perceived the BBF technology as the most useful technology for increasing the production of the crops. Some people also responded that the Shade net technology has also been useful in increasing the income of the farmer.

The percentage of people doing soil testing was found low. In one village, farmers complained that they have given the soil for testing but have not received the reports as of now.

The use of chemical fertilizers was found to be on a large scale in the project villages. The mostly used fertilizer was found to be Urea and DAP in the field. The application of fertilizer was reported to be more during the sowing phase

*“The main challenge that we feel that is there is difficulty in getting the equipment on rent for the farming activities”*

The main challenges faced by the farmers were found to be the insufficient storage facilities for the produce as well as lack of transportation for taking the produce to field as well as from field to the market. There was also a problem in finding and hiring the farm labour also. The farmers were of the opinion that the labour rate is very high. The other challenges faced by farmers are the non-availability of loans from banks. The loan is normally not offered by the bank to the farmers when needed. It was suggested to create a common storage facility in the form of warehouse with minimum rent to the farmers.

Most of the farmers reported that no value addition is done by them before selling their produce, though some farmers reported of doing primary processing (cleaning and grading) of their produce before selling. The urgency of money was the key issue with the farmers due which they were not interested in the value addition of the produce.

*“When we store the produce in home, some insects from the produce are troublesome to be family members, especially to the children. Therefore there is need of storage facility in every village”*

Many farmers said that the main reason for not applying for crop insurance was insufficient knowledge of the crop insurance process. There was also a complaint that the reporting of crop damage is not done properly by inspecting officials, due to which the farmers do not get the insurance claim for the damage. Also, it was found that there was a lack of awareness amongst the farmer claim process against the crop damage, such as reporting the crop damage to the officials within a specified time and correct documents for the application. Some farmers also said that the claim received against the crop damage is not sufficient with respect to the loss and damage of crop. Farmers also perceive that the cost of the insurance is very high, and the claim against the damage is very less.

Almost all farmers expressed their concern about climate-related challenges they have been facing in the last few years. Most of the farmers reported the non-seasonal rainfall as a major reason for the crop failure, followed by the cyclone and heatwave. The farmers mentioned that they do not adopt any particular strategy to cope with climate vulnerability, as they do not have knowledge of coping strategies and that they are helpless against natural calamities.

The key challenges faced by PoCRA supported farmers are:

- a. Lack of storage facilities resulting in the grain damage and immediate selling of produce after the harvest resulting in getting the low price.
- b. The farmer need to go to taluka place for the application of crop insurance and soil testing resulting in expenses as well loss of employment.

### **Feedback from Landless People**

Almost all the landless people are aware of the Nanaji Deshmukh Krishi Sanjivani project being implemented in their villages. The landless people demanded the restoration of activities such as Goat Rearing as well as the poultry. They mentioned that they attend the Gram Sabha every time when it is arranged, but their problems are not addressed properly.

While enquiring about the migration pattern, it was reported to be between 5% to 25% across all the villages. Migration from villages was reported to usually start in October and November (after the Kharif harvesting), and people return around Holi season. On enquiring what kind of support from the government can help them in increasing their income, people reported requiring loan at low interest rates to start their own business. Few respondents also expressed their interest in starting dairy, goat rearing and poultry activities. The perception of the landless people was found to be good regarding the project implemented in the villages. Almost all landless groups were satisfied with the implementation process. On enquiring what kind of support from the government can help them in increasing their income, people reported requiring loans at low-interest rates to start their own business. Few respondents also expressed their interest in starting dairy, goat rearing, and poultry activities.

The key challenges faced by landless people are:

- Because of migration to get employment opportunities, the landless people are unable to take benefits of the schemes at the village level.
- The sugarcane cutting is the main source of livelihood during the migration and comes with the risk of snake bites as well as injuries during the sugarcane cutting.

- Challenges are also faced currently for the finding the livelihood opportunities during the migration as well as when they are in the native village. There is no full-time employment for the landless people in the village.
- The livestock is also taken with the people during the migration, and the major problem is faced when the veterinary services are not availed on time to the livestock when needed. This problem was mentioned in the Patonda village, Taluka Hingoli, District Hingoli in the Landless people FGD.
- Due to the uncertain climate and vulnerable to money, landless people refrain from taking the land on lease for cultivation, perceiving that it may generate a loss in case of crop failure due to uncertain climate.
- Insufficient capital is also the major constraint in establishing an enterprise for livelihood.

### 3.2.15. Verification of Individual and Community/ NRM Assets

As a part of field observation activities proposed in the inception report, Individual and community assets in 10% of a total of 347 project clusters i.e., around 34 project clusters, were verified based on physical inspection and documentation. A checklist of technical specifications for physical verification and list of documents to be verified for each type of asset were provided by PMU. In the case of community works, two assets in each cluster were randomly sampled from the list provided by PMU and verified during the MTR survey. The individual assets were verified during the household survey. A total of 75 individual assets and 68 community assets were verified. The table below lists the type and number of assets verified. All the verified assets were found on site.

Table 25 Individual assets verification

Type of Individual asset	Number of asset visited	Number of assets verified based on physical inspection and documentation	Percentage verification
Drip irrigation	19	19	100
Sprinkler irrigation	41	41	100
Pipes (HDPE/PVC)	4	4	100
Water pumps	7	7	100
Construction of Individual Farm Pond	2	2	100
Shade net house	1	1	100
Small ruminants	1	1	100
<b>Total</b>	<b>75</b>	<b>75</b>	<b>100</b>

**Drip Irrigation:** The submain and lateral dimensions for each asset were checked and were found to be according to the specifications. Other parameters like number of drippers, use of class 1/2/3 inline pipe, and use of screen/ sand/ disc filter were also checked with the beneficiaries and were found to be according to the specifications.

**Sprinkler Irrigation:** The sprinkler pipe with coupler, nozzle sprinkler, sprinkler base, pump connecting coupler and pressure gauge for each asset were checked and found to be as per specifications.

**Pipes (HDPE/ PVC):** The dimensions (length and diameter) and quality of HDPE/PVC pipes were verified and found to be according to specifications. For pumps, the power and energy efficiency ratings were verified and found as per specification.

**Individual Farm Pond:** For individual farm ponds, the following parameters were verified – site selection, availability of a source of water, farm pond dimensions (L X B X H), and farm pond slope (i.e., between 1.5V:1H to 3V:1H) and were found to be as per specification.

**Shade net:** For the shade net, its dimensions (L X B X H) and irrigation system were verified and found to be as per specification.



**Chand Pasha Hasan Sayyad,**  
Village: Talegaon, Tal: Deoni, Dist:  
Latur  
Small farmer (1.6 Ha) from General  
Category



**Nirmala Bai Ramraw kadam,**  
Village: Phutana, Tal: Kalamnuri,  
Dist: Hingoli  
Large farmer (5.2 Ha) from  
General Category



**Gokul Sayaji Nalavade,**  
Village: Kanadgaon, Tal:  
Kannad, Dist: Aurangabad  
Small farmer (1.2 Ha) from OBC  
category



**Daulat Chanduji Mule,**  
Village: Bhirda, Tal: Hingoli, Dist: Hingoli  
Small farmer (1.2 Ha) from SC category



**Narayan Vyankat Jawale,**  
Village: Ghuggi, Tal: Osmanabad, Dist: Osmanabad  
Medium farmer (3 Ha) from General category



**Baburao Sitaram Ghukse,**  
Village: Jamdaya, Tal: Sengaon, Dist: Hingoli  
Medium farmer (2.5 Ha) from ST category



**Ramraw Gangaram Ingle,**  
Village: Bhirda, Tal: Hingoli, Dist: Hingoli  
Small farmer (0.5 Ha) from General category



**Shivaji Rohidas Thavle,**  
Village: Talegaon, Tal: Deoni, Dist: Latur  
Small farmer (0.8 Ha) from General category



**Natharao Santoba Gire,**  
Village: Jamdaya, Tal: Sengaon, Dist: Hingoli  
Medium farmer (2.5 Ha) from ST category



**Satish Navnath Waghmode,**  
Village: Yaswandi, Tal: Washi,  
Dist: Osmanabad  
Small farmer (1.4 Ha) from NT  
category



**Kamalakar Marotrao Kangire,**  
Village: Kamtha, Tal: Ardhapur, Dist:  
Nanded  
Medium farm (0.8 Ha) from OBC  
category



**Kisan Govind Mogale,**  
Village: Narangwadi, Tal:  
Umarga, Dist: Osmanabad  
Medium farmer (2.5 Ha) from  
General category



**Munjabhau Tukaram Harkad,**  
Village: Tandulwadi, Tal: Sailu, Dist: Parbhani  
Medium farmer (2.4 Ha) from OBC category



**Chitanya Surekant Mite,**  
Village: Wadgaon Lakh, Tal: Tuljapur, Osmanabad  
Small farmer (1.4 Ha) from General category



**Satyavan Babaruvan Jadhav,**  
Village: Shelgi, Tal: Nilanga, Dist: Latur  
Medium farmer (2.4 Ha) from General category



**Madisabai Katkade,**  
Village: Undegaon, Tal: Gangakhed, Dist: Parbhani  
Small farmer (0.8 Ha) from NT category

Table 26 Community asset verification

Type of community asset	Number of asset visited	Number of asset verified based on physical inspection and Documentation	Percentage of verification
Community farm pond with inlet and outlet	4	3	75
Community farm pond with lining	10	7	70
Compartment bund	15	11	73
CCT	2	2	100
Deep CCT	5	5	100
Nala deepening	7	6	86
Cement nala bund (CNB)	13	10	77
Graded Bund	12	12	100
<b>Total</b>	<b>68</b>	<b>56</b>	<b>82</b>



**Deep CCT, Village: Undegaon, Tal: Gangakhed, Dist: Parbhani**



**Community farm pond with lining, Village: Gavha, Tal: Sailu, Dist: Parbhani**



**Deep CCT, Village: Undegaon, Tal: Gangakhed, Dist: Parbhani**



**Graded Bund, Village: Kamtha Bk., Tal: Ardhapur, Dist: Nanded**

Along with physical verification of NRM assets on parameters such as site location, dimensions, L-section of drainage, earth work, construction quality, etc., relevant documents of the assets were also verified and found to be satisfactory. Few testimonials of the documents verified are presented below:

**Community farm pond with inlet and outlet at kanadgaon village in Kannad Taluka of Aurangabad district.**

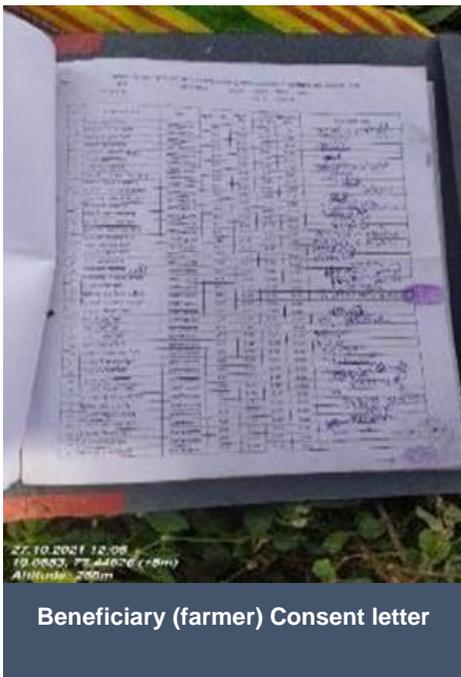


**Consent letter of Government/VCRMC Resolution**

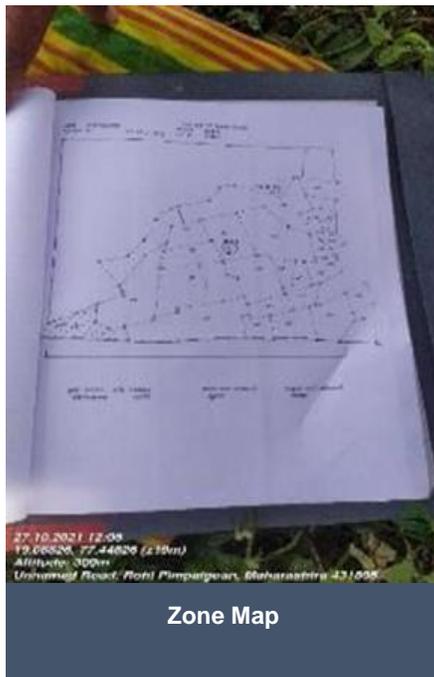


**Measurement book**

**Graded Bund at kanadgaon village in Kannad Taluka of Aurangabad district.**



**Beneficiary (farmer) Consent letter**



**Zone Map**

### 3.3. Component B: Post Harvest Management and Value Chain Promotion

#### 3.3.1. Marketing of Produce

During the MTR survey, the survey team asked the farmers how they sell their harvest (all sources where they sell their produce). It was observed that 49% of the farmers in both project and comparison areas reported selling their produce directly in the haat or via retail mode. It is to be noted that only 22 % of the farmers in the project area and 19 % in the comparison area reported selling their produce in the nearest APMC mandi/market.

The survey team also asked the farmers how they transported the produce to the market in case they did not have it picked up from home. It was observed that farmers mostly use commercial vehicles such as pick-up trucks for transporting their produce to the market (32% in both Project and Comparison). This was followed by the use of light vehicle (Project:25 %, Comparison: 27%) and tractors (Project:35 %, Comparison: 33%). The average distance travelled to sell produce is 31 kilometres in project and 27 kilometres in comparison areas.

Pledge loan scheme<sup>9</sup> is provided by the Maharashtra State Agriculture Marketing Board (MSAMB) for the benefit of farmers of the State. The scheme of pledge loan is available for Moong, Tur, Udid, Soyabean, Paddy, Sunflower, Safflower (Kardai), Gram (Chana), Jawar, Bajra, Maize, Wheat, Ghewda (Rajma), Turmeric, Regime (Bedana), Cashew nuts and Betel nuts (Supari) in this scheme. Under this scheme, a farmer can store his produce in Godowns of APMC and can immediately get 75% cost of his produce at an interest rate of 6%. Farmer can avail the pledge loan facility by storing the produce in the godowns of state Warehousing Corporation or Center Corporation. The APMCs maintain this pledged stock free of cost. The farmers can sell their produce when the prices are higher.

Under the scheme, the farmer gets an agricultural pledge loan up to 75 % of the value of the produce prevailing in the market, an interest rate of 6%. The farmer is allowed to avail this facility up to a period of 180 days. A rebate of 3% on interest is given as promotional incentive to those farmers who repay within 180 days. If a farmer fails to repay within 180 days, then s/he cannot avail the incentive rebate of 3%. After 180 days interest rate will be 8% for next 6 months, after that interest rate will be 12% next 6 months (source: MSAMB website).

The MTR survey team asked the farmers if they were aware of the scheme. It was observed that only 22% of the farmers in project and 21% in comparison areas knew about pledge loan. Of the farmers who were aware of pledge loan, we asked if they had availed this scheme. It was observed that only 19% from project and 26% from comparison areas had done so. Though the percentage of farmers in both project and comparison areas, the biggest reason for not availing pledge loan despite being aware of it was that the farmers felt they did not require it.

Another important aspect which adds to the resilience of farmers is access to cold storage so that they can safely store their produce and sell it at the right time at good prices in the market. However, only 5 % of the farmers in project and 3% in comparison area acknowledged of having access to cold storage facility.

Grading and sorting are basic value addition processes that enable farmers to sell their produce at better prices and with access to better markets. Lack of access to grading and sorting facilities in Marathwada region was observed as only 4% farmers in project and 3% farmers in comparison area reported of having access to grading and sorting facility.

#### 3.3.2. Functioning of the FPCs

##### ***Activities done by FPCs***

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<sup>9</sup> Maharashtra State Agriculture Marketing Board (MSAMB) at <https://www.msamb.com/schemes/pledgefinance>

Out of the total interviewed 24 FPC's, majority of the FPC's were engaged in the Custom Hiring Center Business (14) followed by Cleaning and grading units (6). All these activities were supported by the grant received through the PoCRA. Following is the distribution of the activities done under the PoCRA project by sampled FPC's

Activity	Number of FPC's	Percentage of FPC's
CHC	14	58.3
Dall mill	2	8.3
Cleaning/Grading and aggregation of food grains and selling	6	25.0
Godown	2	8.3
Seed processing	2	8.3
Flour mill	1	4.2
Agri Input	2	8.3
Refer Van	3	12.5
Animal Feed	1	4.2

Table 1. Activities undertaken by the FPC's with the help pf grant received under PoCRA

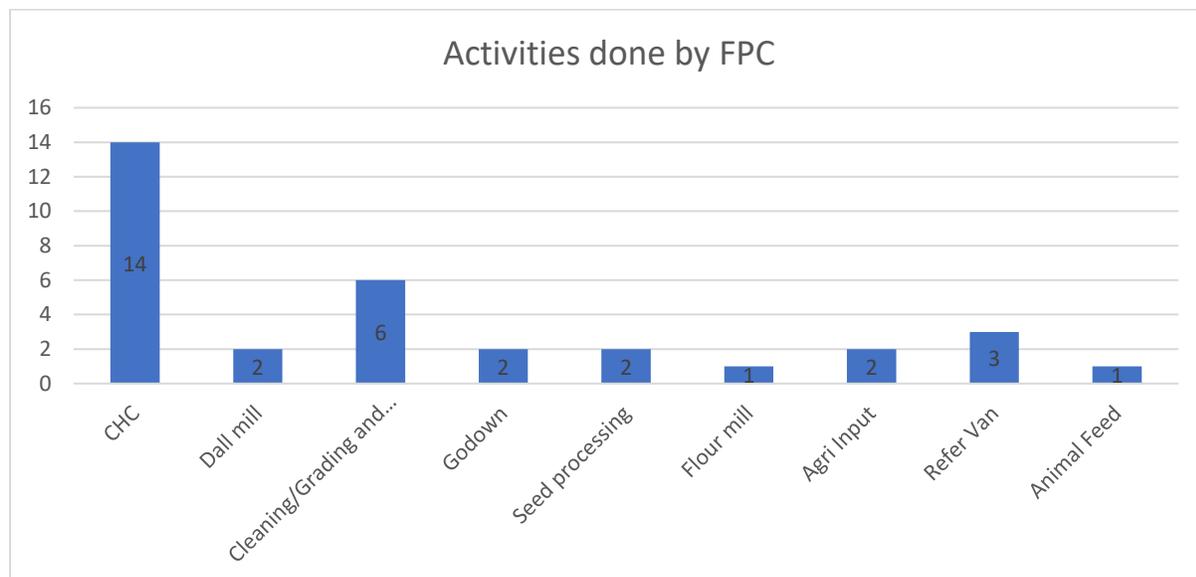


Figure 1. Activities undertaken by the FPC's with the help pf grant received under PoCRA

### Major Challenges Faced by the FPC's in running the Business

The major challenges faced by the FPC's was found to be getting the loan sanctioned from the bank as well as documentation for the same. 41 % (N=10) FPC's reported to have faced this problem followed by the transportation (16%) (N=6) for produce. Some FPC's also said that they faced problem in Capacity Development and lacked technical knowledge for running FPC. 2 FPC's also said that they had problem in preparation if Business plan and they need to pay more for this However, 6 FPC's said that they do not have any problem in running the company.

Challenges	Number of FPC's	Percentage
------------	-----------------	------------

Loan documentation as well as sanction of loan	10	41.7
Transportation	4	16.7
No challenge	6	25.0
Labour	1	4.2
Storage	1	4.2
Capacity Building	2	8.3
Business plan preparation	4	16.7
Procurement	1	4.2

Table 2. Challenges faced by FPC's

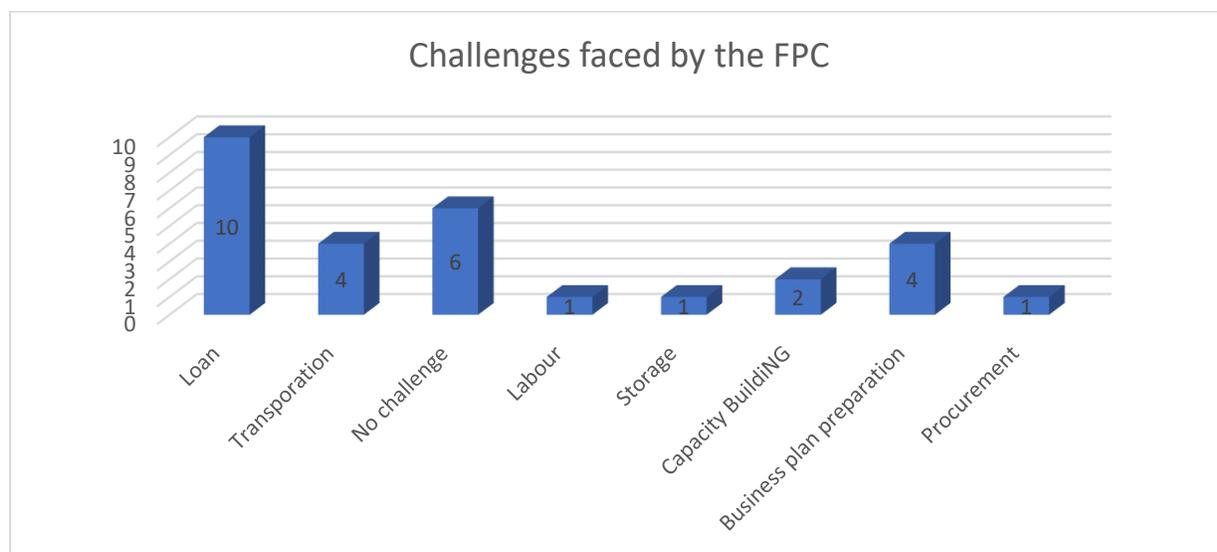


Figure 2. Challenges faced by the FPC's (Number)

### Support needed from Government to sustain the business

70% (N=17) of the FPC's said that they need help on getting the loan sanctioned as well as help in documentation for getting the loan. 12 percent (N=3) said they need help for setting up the infrastructure such as compound as well as shed for the FPC. Other support required was reported as subsidy on transport along with the selling the produce in the MSP of that commodity

Help from government	Number of FPC's	Percentage
Loan facilitation and Documentation	17	70.83
Infrastructure (Shed)	3	12.50
Transportation subsidy	2	8.33
Purchase on MSP	2	8.33

No need of help	1	4.17
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Table 3. Need for help from the government

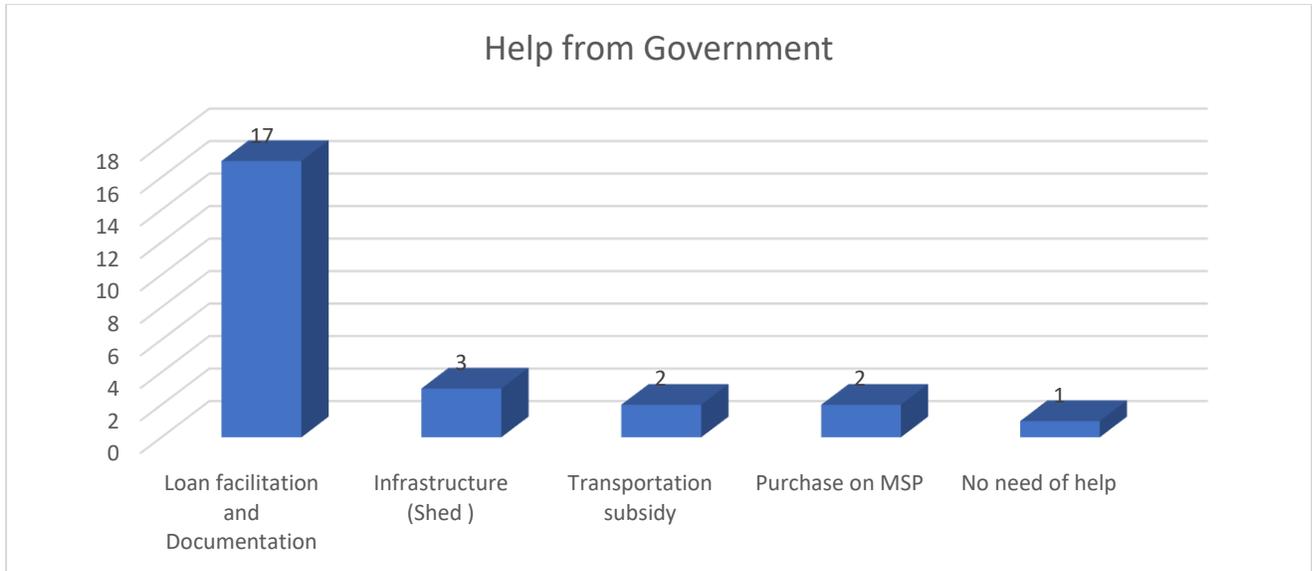


Figure 3. Help and support demanded by the FPC representatives (Number)

### Awareness about the PoCRA

All the interviewed FPC's were aware of the PoCRA project as well as all were the beneficiaries of the PoCRA.

### Application process Experience

22 FPC's said that the process for application was easy, and they received the grant within a span of 2 to 6 months. One FPC found the process complicated for the Custom Hiring Center and one said the process was delayed because the officials did not visit the site for inspection within specified time.

### Perceived Benefits from the Grant received through the PoCRA to villagers

The most useful activity through the FPC was found to be the CHC which saved the time of FPC members as well as farmers who rented the machinery on rent. The saving of time for farmers for finding labour as well as equipment was reported by most of the FPO's i.e. 58% (N=14) followed by the Agro Processing units with 45 % (N=11). The other perceived benefits were found to be availability of Storage for produce, seed processing, refer van and Animal Feed

Availability to villagers	Number of FPC's	Percentage
Getting Equipment on time and time saving	14	58.3
Dall mill and Agro processing in the Village	11	45.8
Availability of Storage for produce	2	8.3
Seed processing	2	8.3
Agri Input	2	8.3

Refer Van/Transportation	3	12.5
Animal Feed	1	4.2

Table 4. Perceived benefits to the villagers through FPC

### Difficulties in Accessing the benefits of the PoCRA

21 FPC's reported that they did not face any problem in accessing the benefits from PoCRA, one representative said that the loan process was delayed by the COVID. One FPC reported that the officials did not come on time for inspection leading to delay. One FPC representative said the delay occurred because he was not aware of the guidelines of the FPC benefits.

### Trainings Attended by the FPC members

Out of the 24 interviewed members of the FPC, 16 have undergone the training on the FPC. The main training was found to be training on the business development (11), maintenance and operation of CHC (3) and agriculture (2). The training received to FPC members were as follows. The trainings were organised mainly at the KVK of the district

Trainings	Number of FPC's
Business Development	11
Maintenance and Operations of CHC	3
Agriculture	2

Table 5. Training Received under POCRA

### Need for Training

The members on asked upon the need for training majority of the representatives said that they need on business management as well as the value chain management such as packing and grading. Many also said that they need training for operation and maintenance of the CHC

### Compliance with Environmental Safeguards

All the structures constructed by the FPC (Godowns and Sheds) were found to complying with the Environmental safeguards

### Key Observations

Majority of the FPCs interviewed are engaged mainly in the activity of the Custom Hiring centre. The other FPCs were interviewed were mainly engaged in the business of procurement and selling of the produce. One had the silage production unit. The membership of FPCs ranged from 1000 to 10 members among the sample size. Many FPOs stated that they give special discount on services to women members which is generally additional 5-10 % less than the actual market rate. The members of the CHC and animal feed are delivered the services which are generally 5 % less than the market rate.

It was found that the farmers are aware of the availing market rates and the use of technology has increased. The most common method for accessing the market rate was browsing through the mobile apps. Some FPCs reported that the use apps such as Market Mirchi and the Maha Sahkar.

It was also found that most of the Board of Directors of FPCs have undergone training related to market linkage as well as business administration, though sources other than PoCRA such as NBARD and Pani foundation. The FPC directors also reported that they get the regular help from the Agricultural Department regarding the market linkage as well as seed treatment. The FPO/FPC representatives were asked about the trainings or capacity building support that can help them to run their organizations effectively. They reported that training on general management accounts, market linkage and preparing a business plan will be helpful for them.

During the key expert field visits, it was found that the business plan was very basic and doesn't include risk and mitigation strategy. Different business scenarios are also missing from the business plan and Directors lack capacity of building a bankable business proposal. During the field visit to the FPCs, namely Jeevrekha Agri-producer Company Limited, Ganeshpur and Khadeshwar Farmer Producer Company, Banegaon it was found that there is representation of women in the board and members, but they did not have equitable representation. To make FPCs more inclusive representation of women, differently able persons, single women, and widow should be encouraged. It is also suggested that the Women membership should be given priority and environment of the FPC should developed so that more and more women become part of the company.

The FPC members see the climate change as the biggest challenge of the future. The members are encouraged to adopt climate resilient practices and technologies. Eg. Inter cropping and use of Bio-char. Members also get weather information from the locally installed weather stations to take real time farming decisions enabling farmers to take climate resilient decisions. FPO members also expressed challenge that they are not getting the support from banks for expansion of the business as banks are asking for the NA properties as Mortgage. Most of FPC's said that the profit is not shared among the members and utilized for the expansion of the business as well some use it for paying off the debt of the FPC.

Table 27 Distribution of membership and employment in 24 FPCs

S.No	Details	Distribution				Remark
1	<b>Number of members</b>	Male		Female		Total 7958 members
		5727	(72%)	2231	(28%)	
3	<b>Member Distribution - Social category wise</b>	SC	ST	General	Others	Small and marginal farmers (62%) dominate membership
		1044 (13%)	422 (5%)	4352 (55%)	2140 (27%)	
4	<b>Member Distribution - Landholding wise</b>	Small	Marginal	Medium	Large	
		2554 (32%)	2395 (30%)	1673 (21%)	1336 (17%)	
5	<b>Persons employed through FPC in last 12 months</b>	Male		Female		Total 884 persons
		661		223		
6	<b>Nature of the employment in the last 12 months</b>	Fulltime	Parttime	Seasonal		
		326	159	442		
7	<b>Average No of days of work in last 12 months</b>	150	40	180		
8	<b>Average Number of working hours perday)</b>	8	5	8		

Small and marginal farmers (62% of total 7958 members) dominate the membership in 24 FPCs surveyed. Support to FPCs has led to increase in agribusiness activities which has in turn led to generation of employment. In past 12 months nearly 884 persons are provided employment in FPCs which includes nearly 25% of women. Table below presents the average turnover and profits for 16 FPCs. There was

increase in annual turnover of FPCs from 2018-19 to 2021. The FPCs also recorded profits. In 2020-21, the average profits increased by nearly 50%.

Table 28 Financial Analysis of 16 FPCs

	Year	Average (Rs.)
Annual turnover for last three financial year (in Rs.)	2018-19	2975162
	2019-20	3749054
	2020-21	6010540
Annual profit for last three financial years (Rs.)	2018-19	115656
	2019-20	117832
	2020-21	176720

**Recommendation:**

- FPCs have started well but now desperately need handhold support/mentorship to take their business forward. Other than business training's FPC members require capacity building inputs on their core activity. E.g. FPC handling storage should get training of warehouse management, Pest management and stock keeping etc. An App based technical repository can be created which can be accessed by the members of FPCs for developing their capacity virtually.
- Engaging technology solution for demand aggregation and output marketing can be explored. A digital platform for input demand aggregation and output selling should be developed and all FPCs supported by PoCRA should be given access to it.

### 3.3.3. Functioning of SHGs

As part of the MTR evaluation, FDGs were conducted with SHG members to understand their current activities and challenges. It was found that out of 24 SHGs interviewed, almost all SHGs were found to be engaged in income generation activities. Majority of SHG's were engaged in income generating activities of Custom Hiring Center, some SHG's were engaged in the business of vegetable production and marketing. On an average, the frequency of savings was found to be monthly which ranged from 100 to 500 Rs per member per month. On being asked about the challenges faced by their SHG, complying to the bank documentation process was reported to be a major challenge.

#### **Member Count**

The 24 SHG's were interviewed for analysis under the Mistrum survey from different districts of Maharashtra. The 24 SHG's had 15 members on average

#### **Activities taken by the SHG**

The most common activity implemented by the SHG was found to be the SHG where 23 SHG's were into this business. The other activities run by them were found to be the Dairy, Polyhouse cultivation and Grading and cleaning unit

Activity	Number of SHG's	Percentage of SHG's
CHC	23	95.8
Dairy	1	4.2

Polyhouse Cultivation	1	4.2
Godown	1	4.2
Grading and cleaning	1	4.2

Table 1 Activities taken by the SHG's

### ***Frequency of savings, loan disbursement and utilisation***

Out of the 24 interviewed SHG's it was found that the 18 SHG's were frequently savings the money, ranging from 100 Rs per month to 5000 Rs per month. 21 SHG's said that the do not revolve the fund and utilise it for the running the business. The other who got the loan as revolving fund are utilising it for the agriculture as well as buying the inputs for agriculture.

### ***Awareness About the PoCRA***

It was found that all the interviewed SHG's were aware about the activities and the grant given for SHG's for PoCRA.

### ***Applying for the benefits under the PoCRA and ease for process***

Almost all the SHG's have applied for the PoCRA and received the benefits from it. All the SHG's found the process simple and easy to many of the SHG representatives. Many said there was help from the Agri Dept. for application

### ***Benefits other than the grant***

Many of the SHG's said that there was help form the department. Apart from subsidy the help was received in terms of training on seed Processing and CHC was most common. The other trainings received were the Agro Processing Market linkage and business development

Help from Department	Number of FPC's
Training on CHC	6
Training on Seed processing	4
Agro Processing	2
Market linkage	4
Business development	2

Table 2. Benefits received other than grant to the group

### ***Perceived Benefits from the Grant received though the PoCRA to villagers***

The most useful activity through the SHG's was found to be the CHC which saved the time of FPC members as well as farmers who rented the machinery on rent. The saving of time for farmers for finding labour as well as equipment was reported by most of the SHG's

### ***Difficulties in accessing the PoCRA benefits***

Almost all the SSHG' said that they do not face any problem in accessing the project benefits, one of the SHG said that their concern is about receiving the grant late.

### ***Support form PoCRA***

One FPO demanded the need of capacity building sessions for building the capacity of farmers. The other demand were to allow grant for Purchasing the excavators like JCB and Poclairn

### ***Suggestions from the SHG's***

The grant must be provided at the earliest was suggested by one of the SHG. One SHG said that the process is little lengthy for application which must be minimised. The other suggestion were related to facilitation of loan as well as receiving the subsidy before purchase of machinery

### 3.3.4. Verification of Agribusiness Assets in Project Supported FPCs and SHGs

Apart from the individual and community assets, agribusiness assets in 24 FPCs and 23 SHGs were verified on various parameters. The data on aspects such as types of machines available in CHCs, display board of agribusiness activities, total capacity of warehouse/ processing units, whether currently operational or not, status of maintenance activities, insurance of agribusiness units, crops processed, etc was collected and was found satisfactory in all the cases. The summary of agribusiness assets verified is provided in the table below.

Table 29 Agribusiness asset verification

Type of agribusiness asset	Number of assets verified in 24 FPCs	Number of assets verified in 23 SHGs
<b>Custom Hiring Centre</b>	20	23
<b>Godown</b>	7	2
<b>Seed processing unit</b>	1	
<b>Vegetable processing</b>		1
<b>Pulse mill</b>	4	1
<b>Oil extraction Unit</b>		1
<b>Grain Processing (Cleaning &amp; Grading unit)</b>	4	
<b>Silage Unit</b>	2	1
<b>Turmeric Processing Unit</b>		1
<b>Cattle feed Processing Unit</b>	1	
<b>Grading and Packing Units</b>	1	
<b>Refer Van</b>	1	1
<b>Goat breeding center</b>	1	
<b>Marketing of Agricultural Produce</b>	3	
<b>Flour mill</b>	1	

**Custom Hiring Centres:** CHCs were verified for type of machine available and project display board. The type of machines available in CHCs of the PoCRA supported FPCs and SHGs as reported by the respondents are as follows:

Table 30 Type of machines verified in CHCs

Type of machine verified in CHC	FPC	SHG
Tractor large more than 35 HP	20	16
Tractor small up to 35 hp	2	4
Harrow	16	10
Plough	20	18
Multicrop Thresher (30 hp and above)	12	8
Multicrop Thresher (Below 30 hp)	7	3
Power weeder	6	-
Power tiller	4	3
Cultivator -9 tyne	15	9
Cultivator -5 tyne	8	5
Reaper	3	1
Trailer (above 1 brass)	13	8
Trailer (below 1 brass)	5	1
Rotavator	17	16
Blower	5	4
Ridger	4	4
Chaff cutter	1	2
Seed drill (BBF) – 9 tyne	15	11
Seed drill (BBF) – 4 tyne	6	7
V-pass machine	6	1
Shredder (Cotton, Maize)	1	-
Mulching machine	1	-
Bed maker	3	1
Land leveler	1	-

**Commodity Processing Units:** Commodity processing units were verified for total processing capacity, commodity processed, maintenance activities, and insurance



Custom Hiring Centre at Sant Gajanan Maharaj FPC, Village: Waghjali, Tal: Sengaon, Dist: Hingoli



Custom Hiring Centre at Sant Namdev Maharaj FPC, Village: Waghjali, Tal: Sengaon, Dist: Hingoli



Custom Hiring Centre at Rayatecha Raja FPC, Village: Kavatha, Tal: Sengaon, Dist: Hingoli



Grain Processing at Sant Namdev Maharaj FPC, Village: Waghjali, Tal: Sengaon, Dist: Hingoli

### 3.4 Component C: Institutional Development, Knowledge, and Policies

#### 3.4.1 Feedback of VCRM/GKVS on Project Implementation

##### ***Gender Sensitivity and Inclusivity***

In all the interviewed VCRM the count of all the members was found to be as per the norms set by PoCRA. The women percentage was found to be 55 % i.e., on an average every VCRM has at least 7 women members. The percentage of small farmers was found to be 39 %, the marginal farmers contributed 35 % and the landless member accounted 7 % of the total count of members.

Members Category	Members (Total N = 208)			
	Small	Marginal	Landless	Women
<b>Members</b>	82	72	15	115
<b>Percent</b>	39.42	34.62	7.21	55.29

Table 1.. Distribution of Members as per land holdings

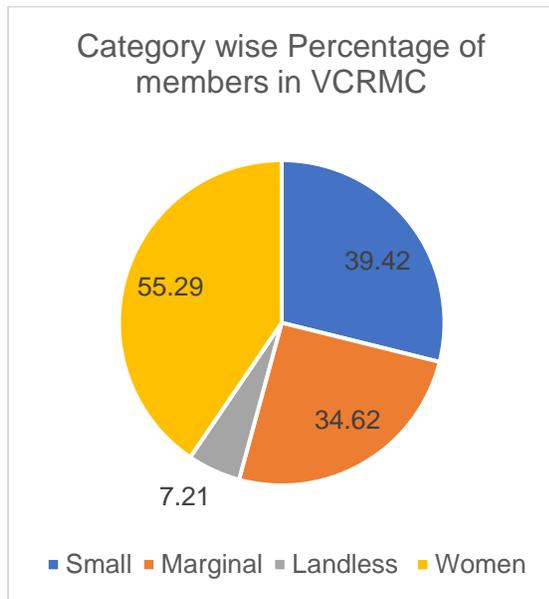


Figure 27. Members of VCRMC percentagewise (N=208) (N=208)

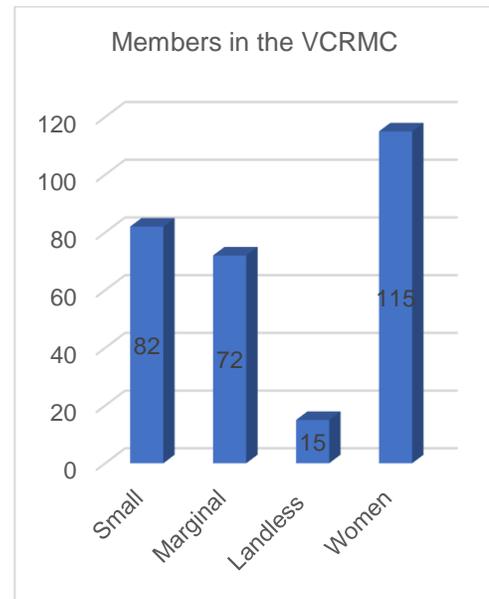


Figure 2. Members of VCRMC

The meeting of the members was conducted every month for as reported by 14 VCRMC's and one VCRMC reported that they meet every 2 months. However, one VCRMC reported that there has been no meeting in last three months due to pandemic. The main purpose of the meeting was to sanction, and scrutiny of the applications done by the farmers and review of the activities under the project.

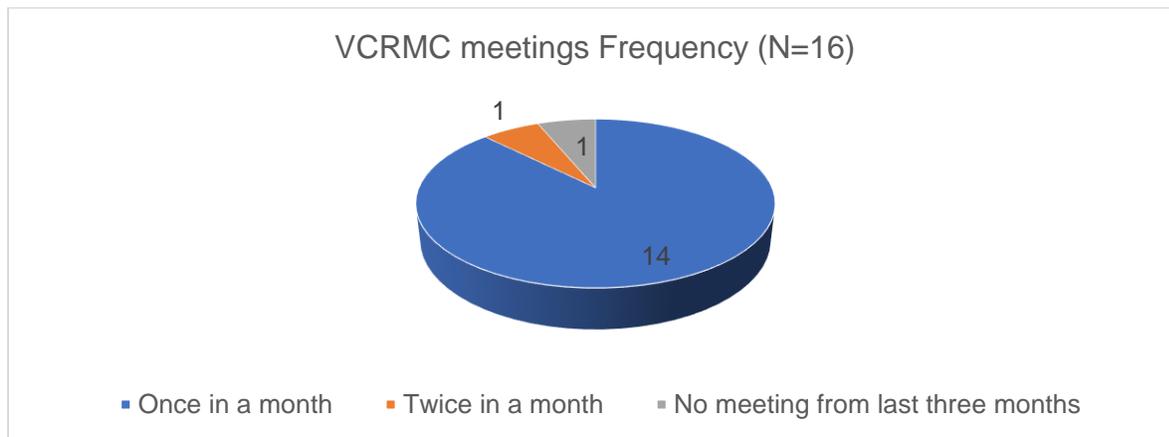


Figure 3. Frequency of meeting conducted by VCRMC

### Irrigation

It was observed that most of the farmers has well as irrigation source and the availability of water in summer for irrigation was available with 10 % people in majority of the villages. The Rabbi water availability was found to be 50 % in most of the villages

### Challenges Faced by farmers and Landless people

Around 70 % of the VCRMC's said that they face acute shortage of the labours in the peak season as the main challenge. The other main challenged faced by them are the non-availability of equipment on time for tillage and harvesting. Higher transportation cost as well limited storage facilities at the village level were other problems mentioned by the VCRMC members regarding the post-harvest management issues. The main challenge faced by landless people in searching livelihood was found to be availability of only limited and seasonal work depending upon the agricultural activities, also the compensation they receive was much less in the villages as compared to the cities. Also, there was no support given to landless under the PoCRA which was much needed. The VCRMC members demanded restoring the activities which are closed for the Landless people.

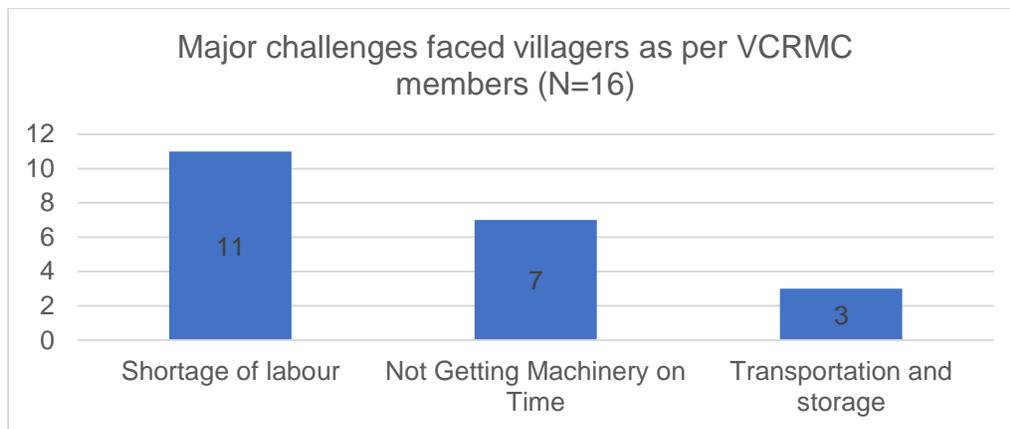


Figure 4. Major Challenges faced by the villagers as per the VCRMC members

### Livelihood Opportunities for the landless in the villages

85 % of the VCRMC said that the main source of livelihood for the Landless people was the goat rearing activity along with the agriculture labour work followed by Brick Kiln worker and Construction labour. Two VCRMC's reported that the entire Landless people from the village migrate for the Sugarcane cutting.

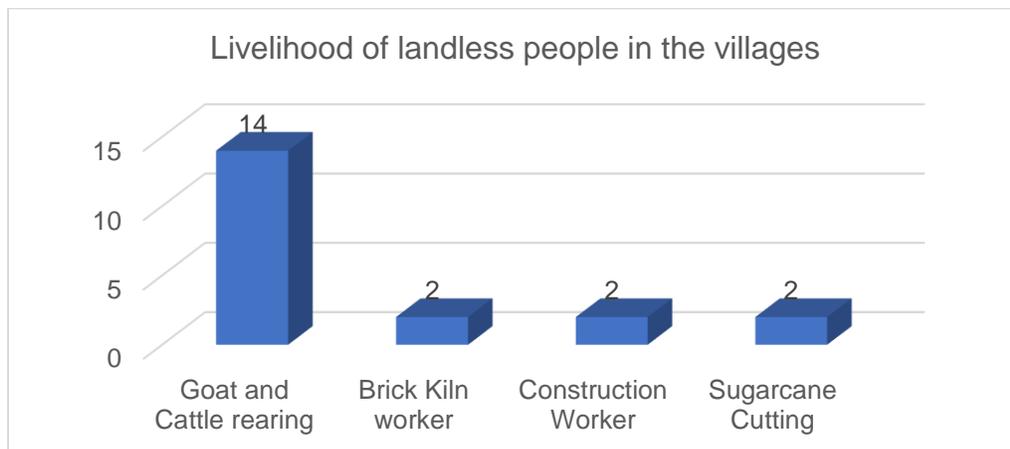


Figure5. Livelihood opportunities for the landless people in the villages

“Awareness regarding the project ranged from 50 % to 100 % in the village and people were found to be taking benefit as per the VCRMC members”.

**Reasons for not availing the benefits of PoCRA**

Upfront investment was found to be the main reason for people not availing the benefits of the scheme. It was also found that the lack of awareness regarding PoCRA in some villages also prevented some people in taking benefits of the project. To overcome this, problem was found to be solved by arranging the meetings with the vulnerable sections and raising awareness as well narrating them the importance of project and its benefits. However, 6 VCRMC’s said that they are not taking any actions to increase participation of all sections of group.

**Problems faced by the Climate change and Coping mechanism**

Almost all the VCRMC’s mentioned that they have faced the problem of climate change at some point in last three years. Almost all of them said that the assets received from PoCRA such as micro irrigation, Farm Ponds and protective cultivation have helped them in there farming system resilient. Majority of the members said that the use of BBF technology had helped them lot during the excess rain avoiding crop damage. Use of climate resilient varieties taught in the FFS sessions was also useful as a coping mechanism for the climate change.

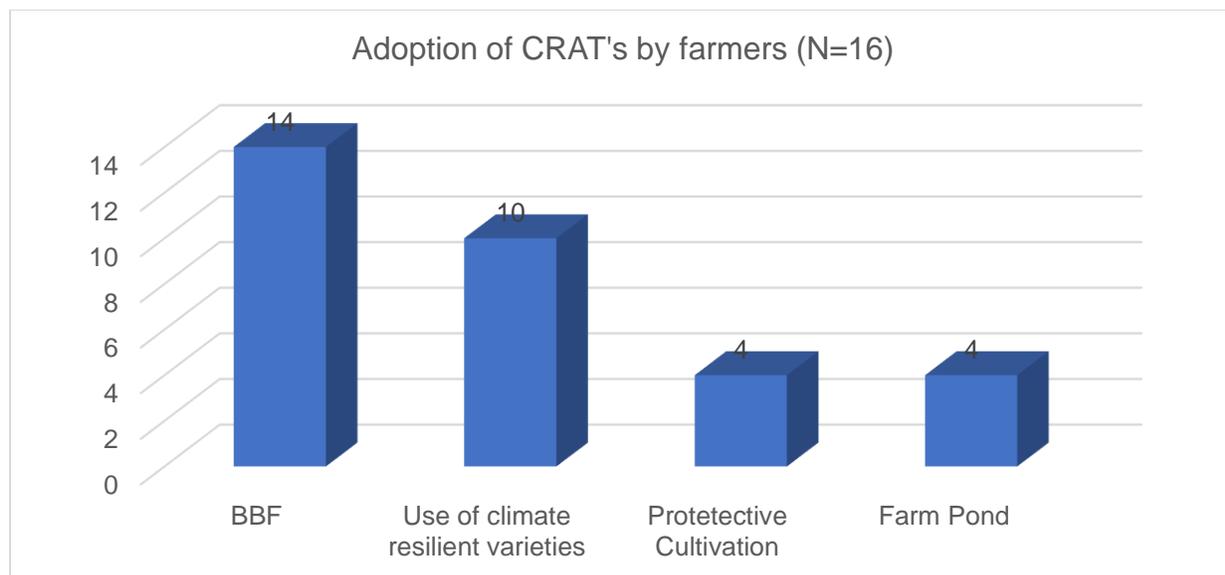


Figure 6. Adoption of Climate Resilient Technologies by Farmers

It was also reported that the FFS sessions were very helpful in the introduction of Climate resilient varieties as well as BBF. The practical demonstration of BBF and pesticide formulations also helped in building the resilience against the climate change.

**NRM Works and Perceived Benefits**

Total Nine NRM works were reported to be done under the PoCRA under the villages. The perceived benefits were found to be the increase in Groundwater level, change in cropping pattern and the increase in Rabbi cultivation area.

**Training by VCRMC Members**

Out of the 16 VCRMC’s interviewed 9 reported that they have received the training on the Orientation and awareness of the project, Microplanning as well as water budgeting, Improved agriculture, and seed treatment.

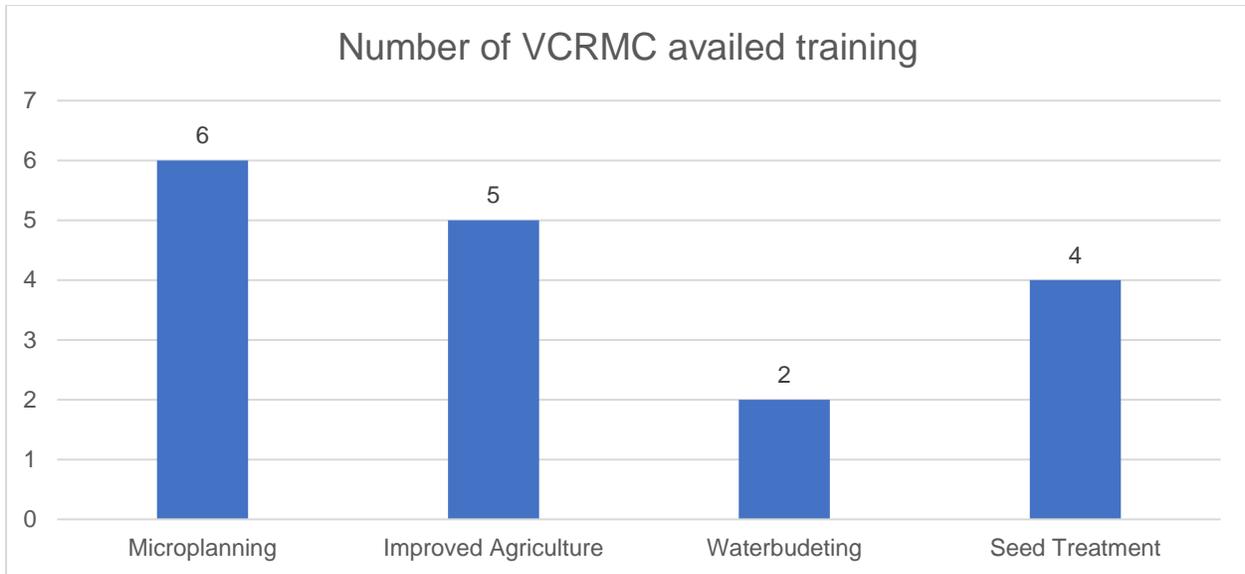


Figure 7. Number of trainings received by the VCRMC's to the members

On asked about the requirement of training the maximum demand was for the training on improved agriculture, Microplanning as well administration and financial literacy

**Recommendations and Solutions as Suggested by the VCRMC members**

1. To overcome the challenge faced by the villagers regarding the shortage of labour and machinery it was suggested that the limit of CHCs to be increased in the village so that farmers will be easily hiring the equipment during the peak season and farmers must also get the equipment on subsidised rate
2. There must be facility of warehouse at the village level for storage of agricultural produce
3. To increase the participation of villagers there was need for restoring the closed activities for landless people as well start the grant for Community Farm ponds as well as pipes and pumps

**Key Observations:**

Many VCRMCs perceive that there are positive changes in the villages related with water availability as the water have increased and water use efficiency has also increased due to the assets provided by the project such as drip and sprinklers. VCRMC members also reported that there has been increase in awareness amongst the farmer for the use of technology related to farming in farmer field school. The increase in knowledge regarding the pest management, safety while spraying was reported by the VCRMC's.

Some VCRMC also reported change in cropping patterns after the inception of PoCRA. The frequency of meeting the case of VCRMCs and Gram Krishi Vikas Samiti (GKVS) was found to be once in a month. The main purpose of conducting meeting by VCRMCs was found to be scrutiny of applications from the farmers as well as discussion on the progress of project. In the case of GKVS the agenda of meeting was found to be giving information to the farmers related to the weather forecast as received from the Agromet advisory of Agriculture Department, the other agendas were observed to be the guidance to members regarding the inputs such as seeds, fertilizers and chemicals.

Out of the interviewed GKVS's two people said that the meeting has not been conducted till now since the formation of the GKVS. The major problem faced by the farmers prior to harvesting according to the VCRMC and GKVS were unavailability of the machinery for the harvesting of crop as well as the shortage of labour. Many farmers also said that the untimely rains also sometimes damage the crop when it is at the harvesting stage.

Almost all the VCRMC's mentioned that the socially vulnerable groups are taking the benefits of the project without any discrimination, in some cases the vulnerable households were unable to take benefits because the habitation was as distant point from the village. The participation of vulnerable groups was also good as per the VCRMC members. It was also observed that no major steps were taken by the VCRMC to increase the participation of the vulnerable groups, however some said that the meetings are arranged for the inclusion of vulnerable groups through training and counselling.

Out of the 16 VCRMCs interviewed, nine reported that they have NRM works in the villages. The main NRM activities in the village were reported to be ENB followed by the compartment bunding. The other mentioned NRM works were the GB, CCT and CNB. According to the VCRMC members, the perceived benefits were the increase in water availability to the adjacent wells in the area in case of CNB and ENB as well as increase in soil moisture in the cases of Grading Bunding and Compartment bunding.

Almost all the VCRMCs said that there was need of capacity building of the members of the VCRMC for the better implementation of the project. The capacity building training demanded by the VCRMC members was subjected to administrative and finance matters as well on the agriculture. Some VCRMCs also demanded that the training on Microplanning and the NRM work is necessary to them. The members of GKVS expressed concern that the PoCRA was to be included in the village as the farmers are easily availing the benefits of PoCRA there are many positive changes in the PoCRA villages such as increase in income of farmer, yield as well as water availability.



FGD with VCRMC, Village Halgara, Tal-Nilanga, Dist-Latur



FGD with VCRMC, Village Murud, Tal-Latur, Dist-Latur



FGD with GKVS, Village Karanjala, Tal-Ambad, Dist-Jalna



FGD with GKVS, Village Mortalwadi, Tal-Udgir, Dist-Latur

### 3.4.2. Feedback on Krushi Tai functioning

- Total 16 Krushi Tai were interviewed in the project villages. The sectorial findings of the KT's were as follows:
- Out of the 16 Krushi Tai's 7 have reported that they have underwent training at some point of time since the joining.
- As reported by the Krushi Tai's, the training was mainly related to learn roles and responsibilities of the Krushi Tai's as well training related to project components such as drip and sprinklers, micro irrigation systems.
- Some KT's also reported that they have received training on the water harvesting as well as goat rearing activity.
- When asked about the reason for attending the training it was reported as non-availability of internet connection for online trainings as well as domestic work was given priority over the training.
- One Krushi Tai said that she was unable to attend the training because it was outside the village boundaries.
- When asked about the DBT priority preference, 8 KT's said that they are aware of the beneficiary prioritization in the DBT application.
- The KT's also said that the work of mobilization was done in the form of door to step visit to the potential stake holder as well as conducting and arranging the meetings for the villagers.

## 3.5. Overall Impact on Project Beneficiaries

### 3.5.1. Improved Standard of Living Index (SLI)

An assessment of the material ownership of the rural households was conducted. The physical assets of the study participants were recorded through observations and enquiry. Standard of Living Index (SLI) was measured by calculating the average of these indicators, with equal weightage given to each question (based on standard NSSO methodology). The SLI is composed of following key indicators viz. type of household, ownership of house, type of toilet facility, source of lighting, type of cooking fuel used, source of drinking water, and number of assets which includes electrical/ electronic equipment, furniture, kitchenware, vehicles, farm equipment, and livestock.

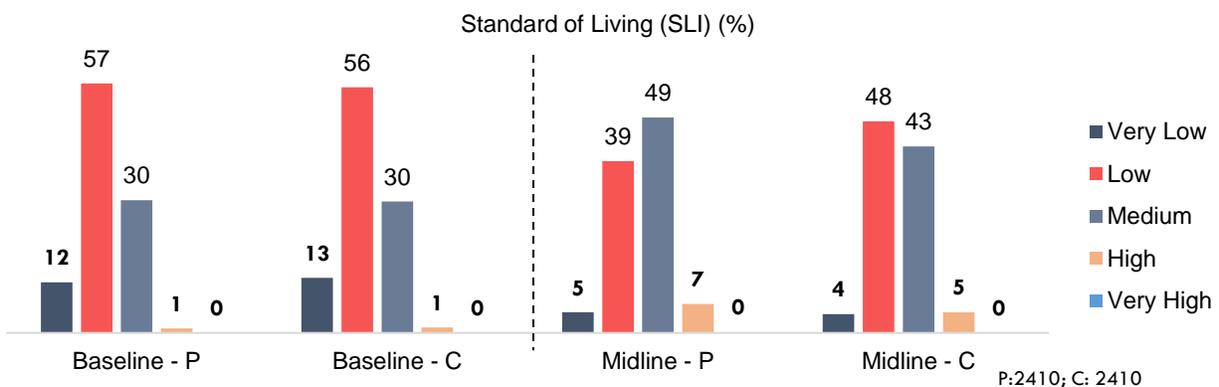


Figure 28 SLI distribution in sample across project and comparison arms

As evident from the above diagram, the distribution of SLI is almost similar across project and comparison area in both baseline and MTR respondent profile. However, when compared with the baseline respondent

profile, an improved standard of living was observed in MTR respondent profile both in project and comparison areas. The percentage of respondents in medium category has increased by 19% in project and 13% in comparison areas. Also, there is 6% increase in high category respondents in project areas and 4% increase in comparison area for same category. Hence, the standard of living seems to have improved more in project arm as compared to comparison arm.

### 3.5.2. Positive Impact on 102 Target Households

To understand the impact of the project on its target beneficiaries, a set of 102 farmer households, identified during the baseline, are tracked in MTR. These households are selected ensuring that they are spread over the project geography. Tracking them over time will help to understand the level of impact the project activities over the period of project implementation. This journey mapping will also help to identify the activities which have contributed significantly in increasing the climate resilience and income of the farmers. Following table shows the progress made by 102 panel households against key economic indicators since baseline.

Table 31 Assessment of Progress of 102 Selected Households since Baseline

S. No	Indicator	Baseline		MTR	
		N	%	N	%
1	Standard of living index (SLI)				
	Very low	13	13 %	1	1 %
	Low	61	60 %	37	36 %
	Medium	28	27 %	54	53 %
	High	0	0 %	10	10 %
2	Mean agriculture land owned	87	4 acres	93	4.5 acres
3	Cultivated land - Kharif	87	4 acres	93	4.5 acres
4	Cultivated land - Rabi	32	2.6 acres	56	2.8 acres
5	Cultivated land – Summer	2	2 acres	10	2.4 acres
6	Irrigated land - Kharif	19	3 acres	44	3.5 acres
7	Irrigated land - Rabi	19	2 acres	42	3 acres
8	Irrigated land – Summer	1	2 acres	8	2.4 acres
9	Annual farm income	137	Rs. 36400	167	Rs. 58500

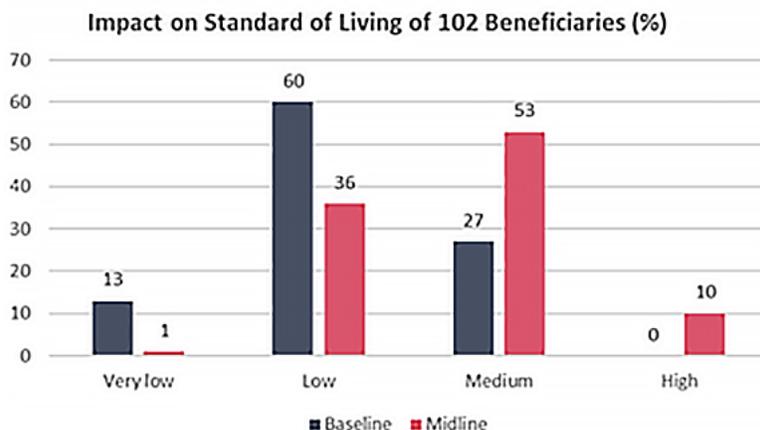


Figure 29 Assessment of SLI of 102 Selected Households since Baseline

As can be seen, the standard of living for most of these 102 panel households has improved. The very low standard of living category in which there were around 13% of households during baseline now ceases to exist. None of the household belonged to high standard of living. It is noteworthy that 10% households now have moved into high category of standard of living over the project duration since baseline. Six additional farmers as compared to baseline now own agriculture land. The average land holding size has also increased by 0.5 acres. The number of farmers cultivating land in Rabi and Summer seasons has also increased when compared to baseline. Number of farmers irrigating their agricultural land in all cropping season has almost doubled. The annual net farm income of these 102 households has increased from Rs. 36400 in baseline to Rs. 58500 in MTR. All these improvement in economic situation of these 102 households implies that there is positive impact of PoCRA intervention on the project beneficiaries.

### 3.5.3. Assessment of Situation (Pre- and Post- PoCRA Intervention) in Project Clusters

The pre- and post-project intervention situation analysis of individual beneficiaries is presented in table below. Note that the individual benefits are availed between year 2018 and 2021.

Table 32 Pre- and Post Situation Analysis of Individual Beneficiaries covered during Mid-term Survey

S.No.	Parameter	Pre Benefit	Post Benefit	Impact
Drip Irrigation (N =153; Gen = 82, OBC = 27, SC = 14. ST = 4, NT = 22, Others = 4)				
1	Area under cultivation in Rabi/Summer Season	2.4 Acres	2.7 Acres	12.5% ↑
2	Income from Produce	50185 INR	63185 INR	26% ↑
3	Amount spent on energy (electricity, petrol, diesel etc) required for irrigation	7053 INR	6925 INR	-1.2% ↓
4	Amount spent on inputs (fertilizer, pesticides, labour etc) required for cultivation	7856 INR	7000 INR	-11 ↓
5	Do you feel that water consumption and wastage on	Yes (88%)		

S.No.	Parameter	Pre Benefit	Post Benefit	Impact
agriculture has reduced post availing benefit?				
Sprinkler (N = 236; Gen = 160, OBC = 33, SC = 10, ST =12, NT = 19, Others = 2)				
1	Area under cultivation in Rabi/Summer Season	2.5 Acres	3 Acres	20% 
2	Income from Produce	38867 INR	50155 INR	29% 
3	Amount spent on energy (electricity, petrol, diesel etc) required for irrigation	6775 INR	5472 INR	-19% 
4	Amount spent on inputs (fertilizer, pesticides, labour etc) required for cultivation	7774 INR	6972 INR	-10% 
5	Do you feel that water consumption and wastage on agriculture has reduced post availing benefit?	Yes (88%)		
Pipes (HDPE/PVC) (N = 46; Gen = 29, OBC = 8, SC = 4, NT = 5)				
1	Area under cultivation in Rabi/Summer Season	2.3 Acres	2.7 Acres	17% 
2	Income from Produce	41920 INR	54539 INR	30% 
3	Amount spent on energy (electricity, petrol, diesel etc) required for irrigation	5328 INR	4470 INR	-16% 
Water pumps (N=30; Gen = 15, OBC = 3, SC = 4, ST =2, NT = 4, Others = 2)				
1	Area under cultivation in Rabi/Summer Season	3.5 Acres	4.0 Acres	14% 
2	Income from Produce	47883 INR	60434 INR	26% 
3	Amount spent on energy (electricity, petrol, diesel etc) required for irrigation	5533 INR	5984 INR	8% 
Construction of individual farm pond/farm pond lining (N = 11; Gen = 8, OBC = 2, SC = 1)				
1	Availability of water for irrigation in Rabi/Summer Season	43 days	92 days	114% 
2	Area under cultivation in Rabi/Summer Season	1.4 Acres	2 Acres	43% 

S.No.	Parameter	Pre Benefit	Post Benefit	Impact
3	Income from Produce	49545 INR	58636 INR	18% 
4	(Ask if farm pond without lining) Level of water in nearby wells	22 feet	22 feet	-
5	Do you use your farm pond for inland fishery activity?	Yes (27% - 3 out of total 11)		27% 
6	Annual Production from inland fishery	Production yet to start		-
7	Income from fishery Produce	Production yet to start		-
Shade net (N = 8; Gen = 5, OBC = 1, SC = 1, NT = 1)				
1	Area under cultivation in Rabi/Summer Season	0.87 Acres	0.94 Acres	8% 
2	Income from Produce	47253 INR	60137 INR	27% 
3	Amount spent on energy (electricity, petrol, diesel etc) required for irrigation	7250 INR	6650 INR	-8% 
4	Amount spent on inputs (fertilizer, pesticides, labour etc) required for cultivation	6625 INR	5750 INR	-13 
5	Do you feel that water consumption and wastage on agriculture has reduced?	Yes (88%)		88% 
Production of foundation & certified seeds of climate resilient varieties (N = 4; Gen = 2, OBC = 2)				
1	Annual Income	27500 INR	40000 INR	45% 
Plantation of horticulture crops (N = 29; Gen = 18, OBC = 5, SC = 3, NT = 2, Others = 1)				
1	Area under horticulture cultivation	1.3 Acres	1.5 Acres	15% 
2	Income from Produce	38965 INR	50793 INR	30% 
3	Amount spent on energy (electricity, petrol, diesel etc) required for irrigation	3741 INR	4583 INR	22% 
4	Amount spent on inputs (fertilizer, pesticides, labour etc) required for cultivation	5655 INR	5586 INR	-1% 
5	Do you feel that water consumption and wastage on agriculture has reduced?	Yes (76%)		76% 

S.No.	Parameter	Pre Benefit	Post Benefit	Impact
Small ruminants (N = 3; OBC = 1, SC = 2)				
1	Annual Income	30000 INR	53333 INR	78% ↑
Sericulture (N = 7; Gen = 6, SC = 1)				
1	Annual Income	29715 INR	34285 INR	15% ↑

### 3.5.4. Assessment of Impact through Success Stories

#### Assessment of impact through success stories



Ms. Maya Bag is heading her household for last 15 years after the demise of her husband in Chichadgaon village of Taluka Vaijapur in Aurangabad district. She has three kids two sons and a daughter. She reported that before the project intervention, her source of livelihood was wage employment. She was also burdened with indebtedness from private money lenders. In 2018, she got associated with PoCRA and availed sprinkler, drip irrigation and pump-set. The PoCRA intervention has changed her life absolutely. Her household income has been increased substantially, and she constructed a residential house as well as storage facilities at her farm.



Mr. Prashant Sanjay Kadam is secretary of Mahatma Phule Shetkari Custom Hiring Centre (CHC) at Padli village, Khultabad. After completing his B.Sc. in Agriculture, he returned to his village and started this centre with the support of PoCRA. He informed that the CHC members contributed Rs.14.5 lakh to buy a 50 HP tractor with trolley, rotovator, cultivator, pherni and other equipment. Upon submitting the bills/receipt for purchase, they received Rs.8.0 lakhs as subsidy from the PoCRA. Mr. Prashant informed that the CHC normally earn between Rs.5,000/- to Rs.7,000/- monthly after deducting the expenses.



Shri Deepak Chavan did his M.Sc. in Chemistry in 2007. He worked for 2 years before returning back to his village in Vadod to take care of his ancestral property and farming. He learned about high demand of silage in one of the farmers' fare he attended. He got subsidy from PoCRA and loan from NANABRD to establish a silage unit. In 2018, he produced 1700 tons of silage. In 2019, he produced 4000 tons of silage. Recently, another buyer 'Godrej Maxin' gave him order for 10,000 tons of silage.



Mr. Mayur RaoSaheb Kadam is a young farmer at Padli, who recently graduated in Agricultural Engineering from Pune. Though, he got job through campus placement, but he came back to his village. He met Cluster In-charge, PoCRA who encouraged him to take farming through Shade-net. The total cost of the Shade-net was Rs.22.8 lakh (4000 sq metre) out of which he received 75% as subsidy from the project. He cultivated cucumber and is expecting 180 quintals produce from his shade-net. After deducting the cost of Rs.75,000/- he expects a net profit of about Rs.1.78 lakhs.

### 3.5.5. Assessment of Impact using Difference-In-Differences Method

The assessment of impact on key indicators is done using difference-in-difference method and tabulated below.

SN	Indicator	Project Area		Comparison Area		Overall Impact (P1-C1) -(P0-C0) %
		Mid-term	Baseline	Mid-term	Baseline	
		P1 (%)	P0 (%)	C1 (%)	C0 (%)	
1	Ease of Access to Irrigation	78	49	59	47	17
2	Land under irrigation					
	<i>Kharrif</i>	55	25	39	22	13
	<i>Rabi</i>	86	46	73	43	10
	<i>Summer</i>	94	75	90	100	29
3	Adoption of Micro-irrigation					
	<b>Drip</b>					
	<i>Aurangabad</i>	45	43	25	51	28
	<i>Beed</i>	20	19	10	27	18
	<i>Hingoli</i>	26	18	14	21	15
	<i>Jalna</i>	26	29	12	29	14
	<i>Latur</i>	19	8	2	14	23
	<i>Nanded</i>	14	9	7	5	3
	<i>Osmanabad</i>	20	20	7	19	12
	<i>Parbhani</i>	16	19	3	27	21
	<b>Sprinkler</b>					

<i>Aurangabad</i>	14	3	4	5	12
<i>Beed</i>	19	12	9	11	9
<i>Hingoli</i>	63	30	47	27	13
<i>Jalna</i>	15	10	2	12	15
<i>Latur</i>	49	26	24	34	33
<i>Nanded</i>	33	28	11	31	25
<i>Osmanabad</i>	43	18	16	17	26
<i>Parbhani</i>	20	21	9	18	8
<b>4 Cropping Intensity</b>	150	112	146	114	6
<b>5 Yield (Quintal/ Acre)</b>					
<i>Cotton</i>	5.97	4.2	5.54	4.6	0.83
<i>Soybean</i>	5.83	5.2	5.41	5.4	0.62
<i>Pigeon Pea</i>	4.52	4.1	3.93	4.3	0.79
<i>Black Gram</i>	4.05	1.5	3	2	1.55
<i>Green Gram</i>	2.83	1.6	2.5	1.7	0.43
<i>Chick Pea</i>	4.82	3.7	4.36	3.6	0.36
<i>Sorghum</i>	4.89	2.3	4.34	2.7	0.95
<b>6 Use of Certified Seeds</b>					
<i>Soybean</i>	72	26	68	24	2
<i>Pigeon Pea</i>	65	24	55	22	8
<i>Chick Pea</i>	61	45	54	43	5
<b>7 IPM impact on pest</b>					
<i>Cotton</i>	37.84	50.3	41.86	48.53	-5.79
<i>Soybean</i>	63.78	63.01	68.88	65.63	-2.48
<i>Pigeon Pea</i>	19.84	26.08	20.1	28.27	1.93
<i>Black Gram</i>	4.04	8.13	2.88	8.24	1.27
<i>Green Gram</i>	2.13	13.04	2.81	14.56	0.84
<i>Chick Pea</i>	33.8	18.56	32.71	20.99	3.52

<i>Sorghum</i>	16.9	27.11	17.15	27.09	-0.27
<b>8 Adoption of CRATs</b>					
<i>Contour cultivation</i>	28.15	11.1	20.99	11.8	7.86
<i>BBF</i>	17.84	3.5	13.24	3.2	4.3
<i>Intercropping</i>	26.89	21.3	22.82	22.9	5.67
<i>Improved seed</i>	40.85	31.2	39.67	30.2	0.18
<i>Seed treatment</i>	14.89	8.5	10.56	9.9	5.73
<i>INM</i>	17.69	11.9	15.35	12.1	2.54
<i>IPM</i>	22.97	16.4	19.52	18.3	5.35
<i>Furrow opening</i>	12.98	3.4	9.3	3.3	3.58
<i>Foliar spray</i>	40.52	18.9	35.02	15.4	2
<i>Farm pond</i>	7.61	2.2	5.92	2.3	1.79
<i>Conservation tillage</i>	17.37	7.2	14.51	8.4	4.06
<i>Biomass</i>	6.07	2.9	5.54	4.2	1.83
<i>Mulching</i>	7.7	3.2	7.65	2.6	-0.55
<i>Citrus on broad ridges</i>	6.63	1.7	4.08	2	2.85
<i>Canopy management</i>	6.3	1.5	4.46	1.2	1.54
<i>Shade net</i>	5.04	0.9	3.38	0.2	0.96
<i>Polyhouse</i>	4.48	0.4	3.71	0.3	0.67
<i>Polytunnel</i>	3.64	0.4	3.29	0.1	0.05
<i>Rainwater harvesting</i>	8.84	5.5	6.76	4.2	0.78
<i>Small livestock</i>	6.76	3.3	6.31	3.3	0.45
<i>Poultry</i>	3.78	2	3.57	1.8	0.01
<i>Sericulture</i>	4.27	0.6	2.95	0.3	1.02
<i>Apiculture</i>	3.53	0.2	2.95	0.1	0.48
<i>Inland fisheries</i>	3.13	0.7	2.77	0.5	0.16
<i>Land preparation</i>	46.08	28	43.19	28.3	3.19
<i>Machinery</i>	45.75	29.6	41.78	26	0.37
<b>9 Crop Insurance</b>					

<i>Cotton</i>	31.2	26	27.3	31	8.9
<i>Pigeon Pea</i>	17	15.7	15	14.4	0.7
<i>Soyabean</i>	73	61.1	73	68.1	7
<i>Chick Pea</i>	14	13.2	12	13	1.8
<b>10 Net Farm Income</b>					
<i>Overall</i>	Rs. 35738	Rs. 21146	Rs. 32812	Rs. 26901	Rs. 8681
<i>Male headed household</i>	Rs. 36224	Rs. 21534	Rs. 33350	Rs. 27207	Rs. 8547
<i>Female headed households</i>	Rs. 10258	Rs. 6630	Rs. 9440	Rs. 12333	Rs. 6521

## 4. Estimates of Results Framework Indicators

This section presents the baseline and MTR values for all the key results framework indicators. The values of these key indicators are presented by project and comparison arms.

### 4.1 Water Productivity

The concept of water productivity is mentioned by Kijne et al. (2003) as a robust measure of the ability of agricultural systems to convert water into produce. It is primarily used to evaluate the function of irrigation systems- as 'crop per drop'. It provides a diagnostic tool to identify low or high-water use efficiency in farming systems or sub-systems. Water productivity is computed at a range of scales and for different agriculture systems.

Water productivity is a key project development objective indicator as part of the results framework of PoCRA. As decided by the key project stakeholders, farm level water productivity calculation methodology, which has been developed by IIT B, has been used to calculate the water productivity for evaluating the impact of PoCRA project. The methodology note developed by IIT- B based on which water productivity values is calculated in MTR (as part of the evaluation of PoCRA) has been presented in Annexure section of this report.

Water productivity has been measured as yield in kg per cubic meter of water(kg/m<sup>3</sup>) provided to a particular crop. Water productivity for different crops varies on different parameters such as per soil type, soil depth, number, and time of watering etc. These have been taken into account while measuring the AET for the crops.

$$\text{water productivity} = \frac{\text{yield (kg)}}{\text{Total water taken up by crop (Rainfall AET + watering AET)(m}^3\text{)}}$$

Where,

Yield in kg = weight of harvested grain in kilograms in 1 acre of land.

Water taken up by crop = water available to the plant as Actual Evapotranspiration due to rainfall + Extra watering provided to the plant as per irrigation type in m<sup>3</sup>.

Actual Evapotranspiration due to rainfall is computed by our plugin which is based on SWAT model based on daily rainfall data, soil type, slope, and crop.

As per the PAD document, water productivity has been calculated for the five main crops of Kharif season, namely Cotton, Soybean, Pigeon pea, Black gram and green gram. In the section below, the water productivity for each of these crops has been given for the two study areas. Outlier values have been excluded from the analysis by omitting the values which were outside two standard deviations. Furthermore,

cases where farmers had reported no yield or crop loss have been excluded from the analysis (for both project and comparison arm). There were 364 cases in which farmers had reported crop loss.

Table 33 Water Productivity of Key Kharif Crops

Crop	Sample		WP Project		Sample		WP Comparison	
	Baseline	Midline	Baseline	Midline	Baseline	Midline	Baseline	Midline
<b>Black Gram</b>	146	84	0.22	0.37	157	62	0.30	0.35
<b>Cotton</b>	890	824	0.34	0.28	853	882	0.36	0.33
<b>Green Gram</b>	190	50	0.26	0.33	228	61	0.28	0.27
<b>Pigeon Pea</b>	411	391	0.38	0.26	470	414	0.38	0.21
<b>Soyabean</b>	1114	1290	0.50	0.52	1222	1454	0.51	0.50
<b>Overall</b>	2751	2639	0.40	0.40	2930	2873	0.42	0.40
		Indicates improvement w.r.t to baseline						
		Indicates lesser value than baseline						

Table 34 Standard Deviation and Confidence Interval (95%) for WP estimates in Project region

Crop	Project			
	n	Mean(kg/m <sup>3</sup> )	Std. Dev.	Confidence interval (95%)
Cotton	824	0.28	0.2	0.26 0.30
Soybean	1290	0.52	1.8	0.42 0.62
Pigeon pea	391	0.26	0.2	0.24 0.28
Black gram	84	0.37	0.2	0.32 0.42
Green gram	50	0.33	0.3	0.25 0.41
Overall WP	2639	0.40		

Table 35 Standard Deviation and Confidence Interval (95%) for WP estimates in Comparison region

Crop	Comparison			
	n	Mean(kg/m <sup>3</sup> )	Std. Dev.	Confidence interval (95%)
Cotton	882	0.33	1.3	0.24 0.42
Soybean	1454	0.50	1.5	0.42 0.58
Pigeon pea	414	0.21	0.2	0.20 0.22
Black gram	62	0.35	0.2	0.30 0.41
Green gram	61	0.27	0.2	0.23 0.32
Overall WP	2873	0.40		

Table 36 Distribution of irrigation types adopted for irrigating key kharif crops

Baseline					
Irrigation Type	Cotton N = 890 (853)	Pigeon Pea N = 411 (470)	Soybean N = 1114 (1222)	Green Gram N = 190 (228)	Black Gram N = 146 (157)
Drip (%)	7 (6)	1 (1)	1 (0)	0 (0)	0 (0)
Sprinkler (%)	2 (2)	4 (3)	5 (4)	3 (2)	3 (4)
Flood (%)	14 (14)	8 (11)	7 (9)	5 (4)	2 (4)
Rainfed (%)	77 (78)	86 (85)	88 (87)	93 (94)	95 (92)
MidTerm					
Irrigation Type	Cotton N = 824 (882)	Pigeon Pea N = 391 (414)	Soybean N = 1290 (1454)	Green Gram N = 50 (61)	Black Gram N = 50 (62)
Drip (%)	14 (5)	6 (2)	2 (0)	4 (0)	1 (0)
Sprinkler (%)	5 (1)	11 (3)	14 (3)	8 (0)	6 (3)
Flood (%)	29 (30)	28 (29)	18 (18)	20 (25)	29 (19)
Rainfed (%)	51 (64)	56 (65)	67 (79)	68 (75)	64 (77)
* Values in brackets are for comparison					

In mid-term evaluation, the estimates of water productivity for Cotton and Pigeon pea were lower than the respective baseline values. This is because water productivity depends on many factors such as rainfall, soil type, soil depth, temperature, mode of irrigation (i.e., flood irrigation, drip, and sprinkler), frequency and time of watering, crop management (mulching practices, etc.), crop damage due to pest/ disease and flood. Therefore, while comparing the baseline with the mid-term, the change observed should be assessed considering a broader perspective, considering the variety of factors influencing the water productivity of crops. The decrease in water productivity for Cotton and Pigeon Pea observed during the mid-term may be attributed to the following factors:

1. Majority of the area, around 82% in project villages, is rainfed.
2. As per IMD data, in 2018 (Baseline) Marathwada region received 33% less rainfall (533 mm) than the normal level (800 mm). Because of the less rainfall, the evapotranspiration was less, due to which the Actual Evapotranspiration (AET) value was lower (Cotton: 331 mm and Pigeon pea: 327 mm) as compared to the mid-term value. On the contrary, during 2021 (Mid-term), Marathwada received 1199 mm, which is 49% higher than normal rainfall, which increased the evapotranspiration and subsequently the AET value (Cotton: 514 mm and Pigeon Pea: 443 mm). AET is defined as actual water used by the crops. It comprises water available for the crops from rainfall and irrigation.
3. The yield of Cotton and Pigeon Pea has increased from baseline (4.2 and 4.1 quintal/acre, respectively) to mid-term (5.97 and 4.52 quintal/acre, respectively). However, the proportional increase in the yield for

these crops (which are long-duration Kharif crops) with respect to an increase in rainfall was not observed during the mid-term survey. This might be attributed to wet spells and flood events during critical crop growth stages. Also, crop loss due to wet spells was observed during the survey. This has been reflected in lower estimates of water productivity.

4. Due to variability in rainfall which results in dry spells, the farmers tend to increase the frequency of irrigations to compensate for the water requirement for crops during the dry period.

5. In control villages, there has been a reduction in overall water productivity values indicating climate variabilities and an increase in the frequency of irrigations using flood methods during the dry spells.

## 4.2 Yield Variability- Soybean

One of the key results framework project development objective indicators is coefficient of variability (CV) which is an important indicator of climate variability. The lower the CV, the lower is the yield and climate variability. PoCRA, during the six years of its implementation aims to bring down the yield variability, this giving stability to crop production and hence reducing climate vulnerability. As per the PAD document, at the base line spatial variability will be calculated. The total area under production for each crop grown by farmers and the total production from that crop has been recorded based on farmer response. To calculate the spatial variability of crop yield of soybean, the team calculated its productivity which is the ratio of total production (in quintal) to the total area under production (in acres).

The coefficient of variation was calculated by dividing the standard deviation of productivity by the mean of productivity (i.e.,  $CV = \frac{\text{standard deviation } S}{\text{mean } \bar{X}}$ ) for the specific crops across the eight districts under Marathwada. The estimation is done on values of yield which are within one standard deviation (nearly 70% of sample) thereby excluding outliers from our analysis. The table below presents the estimates of productivity of Soybean and Pigeon Pea for 2017-18 (year of analysis for PAD), 2018-19 (year for baseline analysis) and 2020-21 (year for MTR analysis) available from secondary data source of agriculture statistics.

Table 37 Estimates of productivity of Soybean and Pigeon Pea 2017-18, 2018-19 and 2020-21

District	Soyabean (Quintal/acre)			Pigeon pea (Quintal/acre)		
	2017-18	2018-19	2020-21	2017-18	2018-19	2020-21
Aurangabad	1.8	2.6	5.1	3.3	1.1	2.9
Beed	2.9	1.0	7.6	2.3	0.4	6.0
Hingoli	4.6	5.6	4.7	3.3	1.6	1.3
Jalna	2.8	3.6	8.1	3.2	1.4	5.5
Latur	4.8	4.1	6.9	4.8	1.9	5.9
Nanded	2.8	5.6	5.5	3.6	3.7	4.4
Osmanabad	2.8	2.2	6.8	3.3	0.9	3.7
Parbhani	3.6	4.5	5.4	6.1	1.8	4.7

(Source: Estimate of area, production and productivity of principal crops)

<http://krishi.maharashtra.gov.in/Site/Upload/Pdf/FOURTH%20ADVANCE%20ESTIMATE%20%202020-21%20DISTRICTWISE.pdf>

[http://krishi.maharashtra.gov.in/Site/Upload/Pdf/final\\_estimates\\_2017-18\\_districtwise.pdf](http://krishi.maharashtra.gov.in/Site/Upload/Pdf/final_estimates_2017-18_districtwise.pdf)

[http://krishi.maharashtra.gov.in/Site/Upload/Pdf/Final\\_advance\\_est\\_2018-19\\_distwise.pdf](http://krishi.maharashtra.gov.in/Site/Upload/Pdf/Final_advance_est_2018-19_distwise.pdf)

The overall CV for soybean productivity in both project and comparison area is around 29%. The below table presents the district wise spatial variability for soybean crop.

*Table 38 Spatial variability of productivity of Soybean across Project study area*

(Note: Values in brackets are those of baseline evaluation)

District	Obs	Mean (Quintal/acre)	Std. Dev.	Coef. of Variation
Aurangabad	16 (6)	6.4 (5.1)	1.6 (2.0)	25 (39) %
Beed	75 (113)	5.0 (5.1)	1.9 (2.0)	37 (39) %
Hingoli	115 (159)	5.1 (5.6)	1.4 (2.3)	27 (41) %
Jalna	83 (99)	5.5 (5.4)	1.6 (2.3)	29 (43) %
Latur	208 (224)	5.8 (5.2)	1.5 (1.8)	26 (34) %
Nanded	127 (154)	5.0 (5.4)	1.2 (1.8)	24 (33) %
Osmanabad	226 (260)	5.6 (5.0)	2.0 (1.7)	35 (34) %
Parbhani	126 (166)	5.0 (5.2)	1.3 (1.8)	26 (35) %
Total	976 (1179)	5.4 (5.2)	1.6 (1.9)	29 (37) %

*Table 39 Spatial variability of productivity of Soybean across comparison study area*

(Note: Values in brackets are those of baseline evaluation)

District	Obs	Mean (Quintal/acre)	Std. Dev.	Coef. of Variation
Aurangabad	27 (13)	5.1 (5.4)	1.7 (2.4)	34 (44) %
Beed	104 (138)	5.5 (4.9)	1.7 (1.9)	31 (39) %
Hingoli	107 (157)	4.5 (5.7)	1.2 (1.8)	27 (32) %
Jalna	114 (109)	5.3 (5.1)	1.6 (1.9)	30 (37) %
Latur	207 (243)	5.1 (5.4)	1.3 (2.0)	25 (37) %
Nanded	133 (151)	4.7 (5.3)	1.1 (2.0)	24 (38) %
Osmanabad	224 (282)	5.6 (5.2)	1.4 (1.9)	25 (37) %
Parbhani	134 (181)	4.5 (5.7)	1.2 (2.4)	26 (42) %
Total	1050 (1274)	5.1 (5.4)	1.4 (2.0)	28 (38) %

### 4.3 Yield Variability- Pigeon pea

To calculate the spatial variability of crop yield of pigeon pea, the team calculated its coefficient of variation across the eight districts under Marathwada applying the same method as the team had used for Soybean. For overall CV of pigeon pea productivity during MTR evaluation, it is 34% in both project and comparison area.

Table 40 Productivity of pigeon pea in project area (Note: Values in brackets are those of baseline evaluation)

District	Obs	Mean	Std. Dev.	Coef. of Variation*
Aurangabad	18 (39)	3.7 (3.6)	1.1 (2.5)	30 (69) %
Beed	46 (50)	4.3 (2.8)	1.6 (2.5)	37 (89) %
Hingoli	36 (29)	3.5 (4.8)	1.7 (3.0)	50 (62) %
Jalna	26 (56)	3.2 (4.4)	0.8 (4.3)	24 (98) %
Latur	66 (104)	4.1 (4.1)	1.6 (2.4)	38 (58) %
Nanded	21 (48)	5.1 (4.6)	1.4 (2.1)	28 (46) %
Osmanabad	40 (114)	4.5 (3.5)	1.3 (2.8)	29 (80) %
Parbhani	30 (69)	3.8 (5.6)	1.5 (2.9)	38 (52) %
Total	283 (509)	4.1 (4.1)	1.4 (2.9)	34 (72) %

Table 41 Productivity of pigeon pea in comparison area (Note: Values in brackets are those of baseline evaluation)

District	Obs	Mean	Std. Dev.	Coef. of Variation*
Aurangabad	20 (22)	4.2 (4.8)	1.6 (3.2)	38 (67) %
Beed	36 (56)	3.5 (3.1)	1.1 (2.7)	30 (87) %
Hingoli	28 (53)	3.1 (4.8)	0.9 (2.4)	29 (50) %
Jalna	33 (50)	3.0 (3.7)	1.2 (2.4)	40 (65) %
Latur	60 (124)	3.2 (4.4)	1.1 (2.4)	33 (55) %
Nanded	25 (93)	4.0 (4.7)	0.9 (3.0)	23 (64) %
Osmanabad	29 (85)	3.4 (4.4)	1.1 (2.1)	31 (48) %
Parbhani	35 (77)	2.7 (4.7)	1.3 (2.8)	49 (60) %
Total	266 (563)	3.3 (4.3)	1.1 (2.6)	34 (60) %

## 4.4 Greenhouse Gas Balance Accounting

As per World Bank PAD document, GHG estimation and balance analysis should have been conducted at the end of PoCRA project cycle i.e., at the end term evaluation stage. However, for overall understanding of the progress at the midterm evaluation stage, GHG balance analysis has been undertaken based on certain assumptions.

The World Bank Environment Strategy (2012) adopted a corporate mandate to account for the greenhouse gas (GHG) emissions for investment lending. The quantification of GHG emissions is an important step in managing and ultimately reducing emissions, as it provides an understanding of the project's GHG mitigation potential. Further, Paris Agreement also mandates reporting of assumptions and methodological approaches including those for estimating and accounting for anthropogenic greenhouse gas emissions to achieve the goals of Article 2.

Agriculture sector is one of the dominant sectors contributing to GHG emissions in India (accounting for 18% of India's GHG emissions) and globally. According to IPCC and the World Bank Report on "Enhancing Carbon Stocks and Reducing CO<sub>2</sub> Emissions in Agriculture and Natural Resource Management Projects" (<http://documents.worldbank.org/curated/en/830421468331786085/pdf/704030WP00PUBL00Stocks00Tookit0web.pdf>), agriculture sector provides opportunity for reducing GHG emissions and in particular enhancing carbon stocks. Enhancing carbon stocks in semi-arid soils will have a positive co-benefit on crop yields and also in building resilience to moisture stress. Thus, synergy between enhancing carbon stocks and climate resilient agriculture development is likely.

In the PoCRA project, the focus is largely on building resilience in agriculture and allied sectors to climate variability, droughts and long-term climate change. The PoCRA project aims to enhance climate resilience and profitability of small holder farming systems in the drought prone semi-arid regions of Maharashtra. It is proposed to incorporate improved agronomic, water and nutrient management, agroforestry, etc., practices to build resilience in semi-arid agriculture, while reducing the GHG emissions and enhancing carbon stocks.

### Accounting methodology

The World Bank has adopted the Ex-Ante Carbon-balance Tool (EX-ACT), developed by FAO in 2010, to estimate the impact of agricultural investment lending on GHG emissions and carbon sequestration in the project area. EX-ACT is a land-based appraisal system that allows the assessment of a project's net carbon-balance, defined as the net balance of CO<sub>2</sub> equivalent GHG that are emitted or sequestered because of project implementation compared to a no project or without project scenario. EX-ACT captures project activities in the following five modules: land use change, crop production, livestock and grassland, land degradation, inputs, and investment.

### Project Activities Relevant for the Analysis

#### *Project area*

In the PoCRA the cropping pattern in the selected districts are dominated by cereals (mostly sorghum and millet), cotton, pulses and oilseeds (soybean). This study was carried out following the baseline survey in 8 districts. Project area (Pa) in these 8 districts covers 18,08,002 ha.

#### *Project activities*

Under the PoCRA project, several interventions have been undertaken to promote climate resilience. Most of the practices or interventions are likely to have implications for carbon stocks. The Annexure provides an overview of project activities and related assumptions for the 'With' and 'Without' project scenarios. All areas apart from the 'with project' area in these districts were considered as 'without project' areas. The 'without project' area (WPa) under these 8 districts is of 3664997 ha. It is assumed that the Without-project situation is the same as the 'Start' project, unless otherwise indicated in the Annex.

The improved and climate resilient practices proposed under the project and considered for GHG accounting, considering the EX-ACT modules, include:

- i. No till and residue retention

- ii. Nutrient management
- iii. Improved agronomic practices
- iv. Water management
- v. Manure application
- vi. Crop residue management

Based on the baseline survey dataset, the cropland area ( $C_A$ ) of a particular crop under the 'with project' and 'without project' situations were estimated with the following equation;

$$[CA]_i = (S[CA]_i / S[CA]) \times P_a$$

Where,  $[CA]_i$  is the area of a particular crop (i) in the project area;  $S[CA]_i$  is the area of a particular crop (i) in the baseline survey. Similarly, the area under a particular crop in the without project area was also calculated based on the baseline survey data. The baseline survey data was also used to calculate the total amount of fertilizer application, electricity consumption, crop production etc. in both 'with project' and 'without project' areas. The forest and degraded land area in the selected districts was given in Table below. District wise livestock data is given in Table.

Table 42 District wise forest and degraded land area.

District	Forest Area (ha) <sup>1</sup>	Degraded land (ha) <sup>2</sup>
Aurangabad	89840	173,000
Beed	20560	332,000
Hingoli	16450	3000
Jalna	9090	3000
Latur	2320	75,000
Nanded	102900	3000
Osmanabad	6670	234,000
Prabhani	6400	10,000

Source: 1Department of Agriculture, Government of Maharashtra<sup>2</sup> NAAS, 2010

Table 43 District wise livestock dataset

Districts	Cattle	Buffalo	Sheep	Goat	Pig
Aurangabad	5,38,572	94,430	88,244	4,31,182	10,646
Jalna	4,21,975	82,073	30,534	3,00,988	4,074
Beed	4,96,368	2,58,440	68,693	4,68,149	3,803
Latur	2,57,508	2,57,187	35,094	1,48,886	6,165
Osmanabad	3,62,422	1,88,446	22,131	2,17,400	590
Nanded	5,02,428	2,36,386	76,893	3,18,564	6,529
Parbani	2,99,861	98,495	31,673	1,71,698	6,428
Hingoli	2,32,203	74,125	16,907	1,54,284	1,670
<b>Total</b>	<b>31,11,337</b>	<b>12,89,582</b>	<b>3,70,169</b>	<b>22,11,151</b>	<b>39,905</b>

Source: Livestock census year 2019 data available on Maharashtra state animal husbandry dept.

[https://ahd.maharashtra.gov.in/sites/default/files/talukawiseLC\\_17112020\\_0.pdf](https://ahd.maharashtra.gov.in/sites/default/files/talukawiseLC_17112020_0.pdf)

## Results of the GHG Balance Analysis

Agriculture development and natural resource management projects are normally expected to contribute to net GHG (in particular Carbon) benefit, as a co-benefit to the resilience building objectives. The table below presents the impact of the project activities on GHG balance including emissions from inputs in the form of fertilizers, pesticides, and energy use (electricity and diesel consumption). The *ex-ante* estimation of the GHG balance using Tier 1 for the PoCRA project is shown to be negative, which means the project implementation will lead to a net carbon sequestration benefit. The main sources of GHG emissions are the inputs such as electricity, and diesel and livestock rearing.

All other interventions are projected to contribute to increasing carbon stocks in soil and tree biomass. Achieving an increase in carbon sequestration is an important *benefit* of the PoCRA project. The net GHG benefit on a per hectare basis for the project area is estimated to be 5.8 tCO<sub>2</sub>/ha/year. The negative GHG balance estimated using EX-ACT shows that the project interventions lead to net GHG emission reductions or net CO<sub>2</sub> sequestration, over the baseline or ‘Without’ project scenario. The project led to mitigation of climate change.

Table 40: Greenhouse Gas balance of project activities under the PoCRA project in Maharashtra (Negative (-) values indicate Net GHG benefits or CO<sub>2</sub> sequestration; Positive values indicate net GHG or CO<sub>2</sub> emissions)

In tCO <sub>2</sub> -e over the whole period analysis				
PROJECT COMPONENTS		WITHOUT	WITH	BALANCE
Land use changes	Deforestation	0	0	0
	Afforestation	-4,372,290	-8,594,732	-4,222,442
	Other land-use	-229,468	-336,197	-106,729
Cropland	Annual	96,095,338	70,367,948	-25,727,389
	Perennial	-2,936,651	-4,302,536	-1,365,884
Grasslands & Livestock	Flooded rice	0	0	0
	Grasslands	0	0	0
Livestock	Livestock	29,783,133	31,658,425	1,875,292
	Forest mngt.	0	0	0
	Inland wetlands	0	0	0
	Coastal wetlands	0	0	0
	Inputs & Invest.	460,276,027	433,841,170	-26,434,857
<b>Total emissions, tCO<sub>2</sub>-e</b>		<b>578,616,088</b>	<b>522,634,078</b>	<b>-55,982,010</b>
<b>Total emissions, tCO<sub>2</sub>-e/ha</b>		<b>53.4</b>	<b>48.2</b>	<b>-5.2</b>
<b>Total emissions, tCO<sub>2</sub>-e/ha/yr</b>		<b>2.7</b>	<b>2.4</b>	<b>-0.3</b>

The details of the assumptions are presented in the Annex.

1. Estimates include proposed interventions for both Kharif (monsoon) and Rabi seasons
2. Total project period is considered to be 20 years – which includes 6 years of implementation phase and 14 years of capitalization phase of the project.
3. The area under ‘Start’ scenario and ‘Without’ project scenario is assumed to be the same, since the area under different crops especially under rainfed agriculture varies from year to year, depending on the monsoon rainfall, which is highly variable. There is therefore no clear year to year trend that can be observed in the area under different crops.

Note that the above estimates are based on the secondary data on forest available in Forest Survey of India 2019. For robust analysis of GHG emissions, the satellite data (Sentinel) for all eight districts are being analyzed to estimate the crop area, forest area, etc., for the years 2016 and 2020. This will help us in revising the GHG estimates during the endline.

## 4.5 Net Farm Income

Farm income is another key results framework project development objective (PDO) indicator to evaluate the impact of PoCRA. Farm income is defined as the net farm income calculated as the sum of net income from crops (gross income from all selling crops i.e., total quantity of each crop sold multiplied by the average price received minus the total cost incurred through the agriculture life cycle in production and selling of crops) and net income from agriculture-allied activities (gross income from sale of produce minus costs of production). The survey team and experts calculated the farm income for values lying within 3SD (99%) of the sample, thereby excluding outliers from our analysis.

The comparator of net farm income was calculated as ratio of net farm income of project area to the net farm income of comparison area. The comparator was calculated as 1.63. The mean annual farm income in project arm is INR 35,738 (N = 2382) as compared to INR 32,812 (N = 2401) in comparison arm.

Further, as required in the PAD document, farm income is also calculated separately for male and female headed households at baseline and mid-line and will be further tracked in end line to see the impact of PoCRA on these different types of households. When the MTR survey team look at the mean farm income of farmers based on land ownership, it was found that the mean net farm income of women-headed households is almost half at INR 10258/- (N = 35) in project area when compared to INR 9440/- (N = 45) in comparison area. In contrast, the average net farm income of male-headed households was found to be INR 36224/- (N = 1824) in project area and INR 33350/- (N = 1956) in comparison area.

## 4.6 Adoption of Agriculture Technology

For a set of 26 climate resilient agriculture technologies which were promoted through PoCRA project, the respondents were asked if they have received any training or have adopted any of these technologies in the last one year. As can be seen in table below, in the baseline, 25% farmers from project and 21% from comparison areas reporting that they received training on any one of the 26 technologies. On enquiring about the adoption status, 43% from project area and 41% from comparison area have reported of adopting at least one of these climate resilient agriculture technologies.

It is observed through the MTR data that there is improvement in both training and adoption of CRAT in project area as compared to comparison area. The training received on at least of the CRATs has increased by 6% as compared to baseline estimate in project area. Comparison area shows no improvement in this regard. Also, there is 13% improvement in adoption of CRAT in project and 10% in comparison areas when compared their respective baseline values.

*Table 44 Training and adoption of at least one CRAT in project and comparison areas*

	Project	Control
Total Sample (N)	2410	2410
Sample with no CRAT training	1663	1895
Sample with no CRAT Adoption	1070	1181
Atleast one CRAT training	747	515
Atleast one CRAT adopted	1340	1229
Atleast one CRAT training	31 %	21 %
Atleast one CRAT adopted	56 %	51 %

	Project	Control
Atleast one CRAT training - Baseline	25 %	21 %
Atleast one CRAT adopted - Baseline	43 %	41 %
Percentage Change from Baseline to MTR		
Atleast one CRAT training	6 %	0 %
Atleast one CRAT adopted	13 %	10 %

## 4.7 Land under Certified Seeds

Certified seeds are an essential tool in the farmer's basket for climate resilient agriculture. These certified seeds can have various improved characteristics like pest resilience, drought-resilience, or higher yield variety. The farmers were asked about the type of seeds they use for cultivating each crop. Farmer's reporting using certified seeds were further asked about the area cultivated using certified seeds. This was used to calculate the percent of land under certified seed for the three crops mentioned in the PAD i.e.- soybean, pigeon pea and chickpea presented in Table below.

Table 45 Percentage of land under Certified Seeds

Crop	Percentage of land under certified seeds							
	Sample (N)		Baseline		MTR		Percentage Change	
	Project	Comparison	Project	Comparison	Project	Comparison	Project	Comparison
Pigeon Pea	390	414	24 %	22 %	65 %	55 %	41 %	33 %
Chickpea	711	707	45 %	43 %	61 %	54 %	16 %	11 %
Soybean	1289	1452	26 %	24 %	72 %	68 %	46 %	44 %

As can be seen from above table, in comparison to baseline values there is significant improvement in percentage of land under certified seeds in both project and comparison areas. Also, for all the three crops under consideration i.e., Pigeon pea, Chickpea and Soybean, the percentage change in land under certified seeds is more in project area than in comparison.

## 4.8 Summary of Result Framework Indicators Assessed during MTR

The summary of result framework indicators calculated as part of the mid-term review survey has been presented below

POCRA Result Framework for Marathwada Region

Project Development Objective Indicators									
Indicator Name	Baseline	YR1	YR2	YR3 (Mid-line)	YR4	YR5	YR6	End Target	Frequency
1. Climate resilient agriculture: Increase in water productivity at farm level (kg/m <sup>3</sup> )									Annual
Achievement <sup>10</sup>	0.40			0.40 <sup>11</sup>					
2. Climate resilient agriculture: Improved yield uniformity and stability (Percentage)									Mid-term and End of Project
<i>Spatial yield variability for oilseeds (soybean) - coefficient of variability (Percentage)</i>									
Achievement	37.00			29.00					
<i>Temporal yield variability for oilseeds (soybean) - coefficient of variability (Percentage)</i>									
Achievement	49.60			41.39 <sup>12</sup>					
<i>Spatial yield variability for pulses (pigeon pea) - coefficient of variability (Percentage)</i>									
Achievement	71.80			34.00					
<i>Temporal yield variability for pulses (pigeon pea) - coefficient of variability (Percentage)</i>									
Achievement	54.60			43.78 <sup>13</sup>					

<sup>10</sup> According to PoCRA PAD of World Bank, the achievement on RF indicator of water productivity is measured from Year 3 onwards and for Kharif season only. (Refer Pg. 41)

<sup>11</sup> Based on the estimation of the AET values from IIT Bombay, the water productivity for five kharif crops in project areas is as follows: Cotton = 0.28 kg/m<sup>3</sup>, Pigeon Pea = 0.26 kg/m<sup>3</sup>, Soybean = 0.52 kg/m<sup>3</sup>, Black Gram = 0.37 kg/m<sup>3</sup>, and Green Gram = 0.33 kg/m<sup>3</sup>.

<sup>12</sup> Estimated using secondary data (Source: Estimate of area, production and productivity of principal crops

<http://krishi.maharashtra.gov.in/Site/Upload/Pdf/FOURTH%20ADVANCE%20ESTIMATE%20%202020-21%20DISTRICTWISE.pdf>

and assuming standard deviation of 2.5 in the distribution Soybean data.

<sup>13</sup> Estimated using secondary data (Source: Estimate of area, production and productivity of principal crops

3. Net greenhouse gas emissions (tones/year)							End of project
Achievement <sup>14</sup>	-8,178,753			-55,982,010			
4a. Annual farm income - Total (ratio)							Mid-term and End of Project
Achievement <sup>15</sup>	1.00			1.63			
4b. Farm income (ratio of farm income for women headed HH in project) (ratio)							Mid-term and End of Project
Achievement <sup>16</sup>	1.00			1.55			
4c. Farm income (ratio of farm income for male headed HH in project) (ratio)							Mid-term and End of Project
Achievement <sup>17</sup>	1.00			1.68			
5a. Farmers reached with agricultural assets or services (Number)							Semi annual
Achievement	0			9,68,441 <sup>18</sup>			
5b. Farmers reached with agricultural assets or services - Female (Number)							Semi annual
Achievement <sup>19</sup>	0			Approx. 23% of total farmers			

<http://krishi.maharashtra.gov.in/Site/Upload/Pdf/FOURTH%20ADVANCE%20ESTIMATE%20%202020-21%20DISTRICTWISE.pdf>

and assuming standard deviation of 1.5 in the distribution of Pigeon Pea data.

<sup>14</sup> Provisional figure, to be cross-checked.

<sup>15</sup> Baseline figure of net farm income is Rs.21,928/-, and MTR figure is Rs.35738/-. The estimate of MTR is statistically significant at 95% confidence level.

<sup>16</sup> Baseline figure of net farm income of female headed household was Rs.6,630/-, and MTR figure is Rs.10258/-

<sup>17</sup> Baseline figure of net farm income of male headed household was Rs.21,534 /-, and MTR figure is Rs. 36224/-

<sup>18</sup> DBT farmer = 457,307 + FFS farmers = 267,959 + farmers' training = 134,175 + Exposure visit = 1090 + training to VCRMC member = 28,301+ training to KT = 1738

<sup>19</sup> Gender segregated data for DBT, FFS and VCRMC training is not available.

Intermediate Results Indicators									
Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target	Frequency	
Farmers adopting improved agricultural technology (Number)									Annual
Achievement <sup>20</sup>	0			2142 <sup>21</sup> (89%)					
Farmers adopting improved agricultural technology - Female (Number)									Annual
Achievement	0			Approx. 16% of total farmers					
Area provided with new/improved irrigation or drainage services (hectare)									Annual
Achievement	0.00			98,930.40					
Climate resilient agriculture: Improved availability of surface water for agriculture (from new farm ponds) (cubic meter)									Semi-annual
Achievement	0			1,95,71,000					
Climate resilient agriculture: Area with GAPs for improved management of saline and sodic soils (enhanced soil health) (hectare) <sup>22</sup>									Semi-annual
Achievement	0.00			N.A.					

<sup>20</sup> Data not available as improved agricultural technologies to be defined.

<sup>21</sup> Estimated from 2410 HHs covered during MTR survey in Project Areas

<sup>22</sup> This indicator is not applicable in Marathwada region, as there is not saline or sodic soil

Indicator Name	Baseline	YR1	YR2	YR3	YR4	YR5	End Target	Frequency
Share of crop production area (pulses and oilseeds) under cultivation with climate- resilient varieties (Percentage)								Annual
Achievement <sup>23</sup>	29.00	44.00 <sup>24</sup> Pigeon Pea = 18 Chick Pea = 62 Soybean = 40	76.00 <sup>25</sup> Pigeon Pea = 54 Chick Pea = 72 Soybean = 85	66.00 Pigeon Pea = 65 Chick Pea = 61 Soybean = 72				
Project-supported Farmer Producer Companies with growth in annual profits (Number)								Annual
Achievement	0			16 <sup>26</sup>				
Strategic Research and Extension Programs (SREP) with internalized climate resilience agenda (Number) <sup>27</sup>								Annual
Achievement	0			0				
Clients receiving services from the MH Climate Innovation Center (Number) <sup>28</sup>								Annual
Achievement	0			0				
Beneficiary participation and civic engagement: approved participatory mini watershed plans implemented or under implementation (Number)								Semi-annual
Achievement	0			533				

<sup>23</sup> Baseline and MTR figures are estimated for oilseeds (soybean) and pulses (pigeon, chickpea)

<sup>24</sup> Value estimated during Concurrent Monitoring Round 2.

<sup>25</sup> Value estimated during Concurrent Monitoring Round 5.

<sup>26</sup> Out of 58 FPCs supported by the project, 30 have submitted their audit reports, and 16 have registered profit.

<sup>27</sup> To be captured in MIS from next round

<sup>28</sup> Maharashtra Climate Innovation Centre is planned to be established in year 4.

Goal/ Objective	Activities	Outputs	Outcome	Impact
<p>To enhance climate-resilience and profitability of smallholder farming systems in selected districts of Maharashtra</p>	<p><b>Comp A: Promoting Climate Resilient Agriculture</b></p> <p>Participatory development of mini watershed plans</p> <ul style="list-style-type: none"> <li>• Preparing cluster level plans</li> <li>• Mobilization of farmer communities</li> </ul> <p>Climate smart agriculture and resilient farming systems</p> <ul style="list-style-type: none"> <li>• Demo. of CRA practices through FFS</li> <li>• Enhancement in carbon sequestration</li> <li>• Protected cultivation</li> </ul> <p>Promoting an efficient and sustainable use of water for agriculture</p> <ul style="list-style-type: none"> <li>• Catchment treatment</li> <li>• Drainage line treatment</li> <li>• Construction of new water harvesting structures</li> <li>• Rejuvenation of old water harvesting structures</li> <li>• Construction of groundwater recharge structures</li> <li>• On-farm water security (Compartment /graded bunding)</li> <li>• Micro irrigation</li> </ul> <ul style="list-style-type: none"> <li>• Protective irrigation</li> </ul> <p><b>Comp B: Post harvest management</b></p> <p>Promoting farmer producer companies</p> <ul style="list-style-type: none"> <li>• Resource Agency Cost for support to existing FIGs/ FPOs/ FPCs</li> <li>• Establishing custom hiring centres</li> </ul> <p>Strengthening Emerging value chains</p> <ul style="list-style-type: none"> <li>• Support to FIGs/FPOs/FPCs for product aggregation, handling, transformation &amp; marketing</li> </ul> <p>Improving the Performance of Seed Supply Chain</p> <ul style="list-style-type: none"> <li>• Production of foundation &amp; certified seed of climate resilient varieties</li> <li>• Development of seed hub-infrastructure support</li> </ul> <p><b>Comp C: Institutional Development, Knowledge, and Policies</b></p> <ul style="list-style-type: none"> <li>• Updation of SREPs aligned to Climate Resilient Agriculture</li> <li>• Agro-met advisory services</li> <li>• Preparation and updation of contingency plans</li> <li>• Preparation of Long-term climate change models</li> <li>• Preparation of Risk Analysis Framework</li> <li>• Maharashtra Climate Innovation Centre</li> <li>• Analytical studies pertaining to climate resilience</li> <li>• Agricultural Innovations - demonstrations/ testing/consolidation</li> <li>• Strategic Partnership with other institutes</li> <li>• Capacity Development</li> <li>• MIS and ICT • Information, Education and Communication (IEC)</li> </ul>	<p>Participatory development of mini watershed plans</p> <ul style="list-style-type: none"> <li>• 533 Cluster Level plans developed</li> <li>• Krishi Mitras mobilized at village level</li> </ul> <p>Climate smart agriculture and resilient farming systems</p> <ul style="list-style-type: none"> <li>• CRA practices demo. at village level through FFS</li> <li>• 21 on Bamboo plantation and 80 Agroforestry</li> </ul> <p>Promoting an efficient and sustainable use of water for agriculture</p> <ul style="list-style-type: none"> <li>• 14 Treatment of catchment areas by developing contour trenches</li> <li>• 36 nala bunds, gabion, ENB and CNB constructed</li> <li>• 5192 community and individual farm ponds constructed</li> <li>• 119 old community and individual farm ponds repaired/desilted</li> <li>• 11 Groundwater recharge structures constructed</li> <li>• 334 graded bunding done to improve on farm water security</li> </ul> <p>Promoting farmer producer companies</p> <ul style="list-style-type: none"> <li>• Resource agency deployed for supporting existing FIGs/FPOs/FPCs</li> <li>• 126 Custom hiring centres established</li> </ul> <p>Strengthening Emerging value chains</p> <ul style="list-style-type: none"> <li>• Support provided to 48 FIGs, 58 FPCs and 35 SHGs for product aggregation, handling, transformation &amp; marketing</li> </ul> <p>Improving the Performance of Seed Supply Chain</p> <ul style="list-style-type: none"> <li>• Foundation &amp; certified seeds of climate resilient varieties produced</li> <li>• Seed processing equipment and sheds provided for 1000 MT capacity.</li> <li>• Skilling done for seed producing farmers</li> <li>• Seed quality testing facilities strengthened</li> </ul> <ul style="list-style-type: none"> <li>• SREPs updated to be aligned to climate resilient agriculture</li> <li>• Services provided for Agro-met services</li> <li>• Contingency plans prepared and updated</li> <li>• Long term climate change models prepared</li> <li>• Risk analysis framework prepared</li> <li>• Formation of Maharashtra Climate Innovation Centre (CICs)</li> <li>• Analytical studies conducted pertaining to climate resilience</li> <li>• Agriculture innovations are demonstrated/tested/consolidated</li> <li>• Strategic partnerships developed with other institutions</li> <li>• Capacity building for all stakeholders involved in implementation done</li> <li>• MIS and ICT support systems developed for project execution</li> <li>• IEC material developed for project execution</li> </ul>	<p>Improved soil and water conservation through micro watershed plans</p> <p>Increased adoption of improved agriculture technologies promoted</p> <p>Enhanced agricultural productivity and achieving stability and uniformity in yield</p> <p>Increased carbon sequestration and reduction in greenhouse gas emission</p> <p>improved water use efficiency at the farm level</p> <p>Increased number of strengthened and financially sustainable FPCs</p> <p>Increased uptake of climate resilient crop varieties and improved agricultural technology</p> <p>Climate resilience agriculture systems in project area</p> <p>Enhanced farm income of women headed household and of farmers from vulnerable community</p>	<p>Enhance climate resilience and profitability of smallholder farmers</p> <p>A more Climate Resilient Agriculture sector</p> <p>Household food and income security</p> <p>Achieving better gender and social equity in agriculture sector</p> <p>Enhanced Contribution to India's INDC (COP 21)</p>

Indicator No. <sup>29</sup>	Indicator	Measurement technique and data source	Progress at CM Round 5
5	Number of farmers reached with agricultural assets or services (% of female)	The data of number of farmers reached with assets or services has been collected from the project MIS, associated applications and relevant project personnel from PMU. The number of direct beneficiaries of the PoCRA include:	<i>Total number of farmers/beneficiaries reached through the project till 30<sup>th</sup> September 2021 is 9,68,441 (513686 Male and 454755 Female)</i>
		1. The data on individual grant beneficiaries has been taken from DBT portal.	Total Disbursement online- 209415 (37585 Female and 171830 Male) Total Registrations till date- 516752 (110471 Female and 406281 male) Total valid Applications- 1025347 Total Number of Beneficiaries- 150087 (Male- 122368 and Female- 27719)
		2. The data of beneficiaries of FFS has been taken from FFS application.	Total Number of FFS participants till date are 451689. The total number of Guest farmers are 435231 and host farmers were 16458. The percentage of female are 10.73, with female count of 48474 <i>Total Number of Host farmers attended during the season of Kharif 2021 are 3735 (843 female farmer and 2892 male Farmer). The total number of guest farmers attended the FFS sessions are 179992 (27448 female farmers and 152504 male farmers) Current Round</i>
		4. People who have availed trainings under the program.	12312 trainings events including Project Officials and Farmers (with participation from 100855 male and 33320 female); 76 exposure visit (with participation from 655 males and 435 females) have been conducted. 28301 VCRMC members have been trained along with 1738 KT
7	Area provided with new/improved irrigation or drainage services (in ha)	The data of area with new or improved irrigation services and drainage services through individual activities under the project has been taken from DBT portal report. The data of community level new/improved irrigation services has been taken from Project Specialists of the project districts. Total area under Irrigation Projects= IP (Irrigation Project) <sub>1</sub> *Area under irrigation project+ IP (Irrigation Project) <sub>2</sub> *Area under irrigation	Area provided with 1. Sprinkler and Pump together- 313 Ha 2. With water pumps only - 1151 Ha 3. With only pipes is 17470 Ha 4. Sprinkler area - 44523.4 Ha 5. Drip area 35473 Ha Total Area – 98930.4 Ha

<sup>29</sup> as per PoCRA Results Framework

		project+ IP (Irrigation Project) n*Area under irrigation project	
8	Surface water storage capacity from new farm and community ponds (in 1,000 m3)	<p>The data of individual level farm ponds will be taken from DBT portal report. The data of community farm ponds has been taken from DBT Portal.</p> <p>Total Water storage capacities of new Farm Ponds = FP (Farm Pond)  <sub>1</sub>*Storage capacity of FP+ FP  <sub>2</sub>*Storage capacity of FP+.....+ FP  <sub>n</sub>*Storage capacity of FP</p> <p>Total Water storage capacities of new Community Ponds = CP (Community Pond)  <sub>1</sub>*Storage capacity of CP+ CP  <sub>2</sub>*Storage capacity of CP+.....+ CP  <sub>n</sub>*Storage capacity of CP</p>	19571 (1000 m3)
11.	Number of project-supported FPCs with growth in annual profits	<p>With the support of PS agriculture, the FPC representatives was contacted and their annual profit details of current year and last were enquired. Based on the analysis of the change in annual profits of the supported FPCs this indicator was to be calculated</p>	<p>16 out of 30 whose audited financial statement for FY 2020-21 were available*</p> <p>*Of the 58 project supported FPCs, 2 has received grant in 2019-20, 32 in 2020-21, and 24 in 2021-22. Since most of the FPCs has received grant from PoCRA starting 2020-21, we analysed the financial statements of 32 FPCs for year 2020-21. However, of these 32 FPCs, 30 FPCs has shared their audited statement for FY 2020-21 in which it is observed that 16 FPCs has recorded profit despite the Covid 19 pandemic situation. The support which these FPCs received from PoCRA helped them sustain their agribusiness activities and register profits. It must be noted that since the grant to remaining FPCs are provided recently (that is in financial year 2020-21), it is likely and anticipated that the other 14 FPCs will see benefits in terms of profits in subsequent financial years. The RF indicator implying number of project supported FPCs with growth in annual profit can only be estimated when we monitor these FPCs and analyze their audited statements over next two financial years. The remaining FPCs will be subsequently included in the analysis over next monitoring rounds once their audited financial statements are available</p>
14	Number of approved	This indicator will be reported as an absolute number of participatory mini	Number of approved participatory mini watershed plans implemented / under

*participatory mini watershed plans implemented / under implementation* watershed plans approved by Gram sabha. The information is collected by the microplanning agencies from the offices of the SDAOs. The microplanning agencies submit the validated mini watershed plans to the PMU where the data is recorded by the M&E specialist. implementation are 533 till 31<sup>st</sup> March 2021 out of 533 villages in which implementation started.

## 4.10 Assessment of Land Use Cover using GIS

### Objectives of GIS component:

- 1) To understand the impact of rainwater recharge structures at the village level through agriculture land expansion
- 2) Comparison of baseline data of Land Use and Land Cover (LULC) in 2016 with 2021 LULC data for eight sample project clusters, one each from eight project districts in Marathwada region of Maharashtra

### Study area:

The study focuses on eight sample project clusters, one each from Aurangabad, Jalna, Hingoli, Nanded, Parbhani, Beed, Latur, Osmanabad district. The total area of eight districts is 64679.73 sq. km. One cluster from each district is selected purposively such that cluster has phase 1 villages with Natural Resource Management (NRM) works carried out under the project in at least one of village. Table 24 below presents the list of sample villages to be covered under the study.

### Methodology:

The methodology involves satellite data processing and development of GIS database. For satellite data processing image processing software will be used. For understanding the impact of recharge structures, we will consider the agricultural land expansion as the key indicator. We will also consider other indicators like green cover expansion, barren land reduction, etc. Using freely available satellite data (Landsat 8), we will prepare LULC for sample eight project clusters of project districts. LULC data of 2016 which is available with PMU will be used for pre and post LULC change detection analysis at the cluster level. Village level LULC change analysis for the 58 sample villages will also be carried out. A brief outline of the research methodology is presented as follow:

Software tools required: ArcGIS, Erdas Imagine

Satellite data used: Landsat 8 data of 2016 and 2021 is used for generating the LULC GIS maps

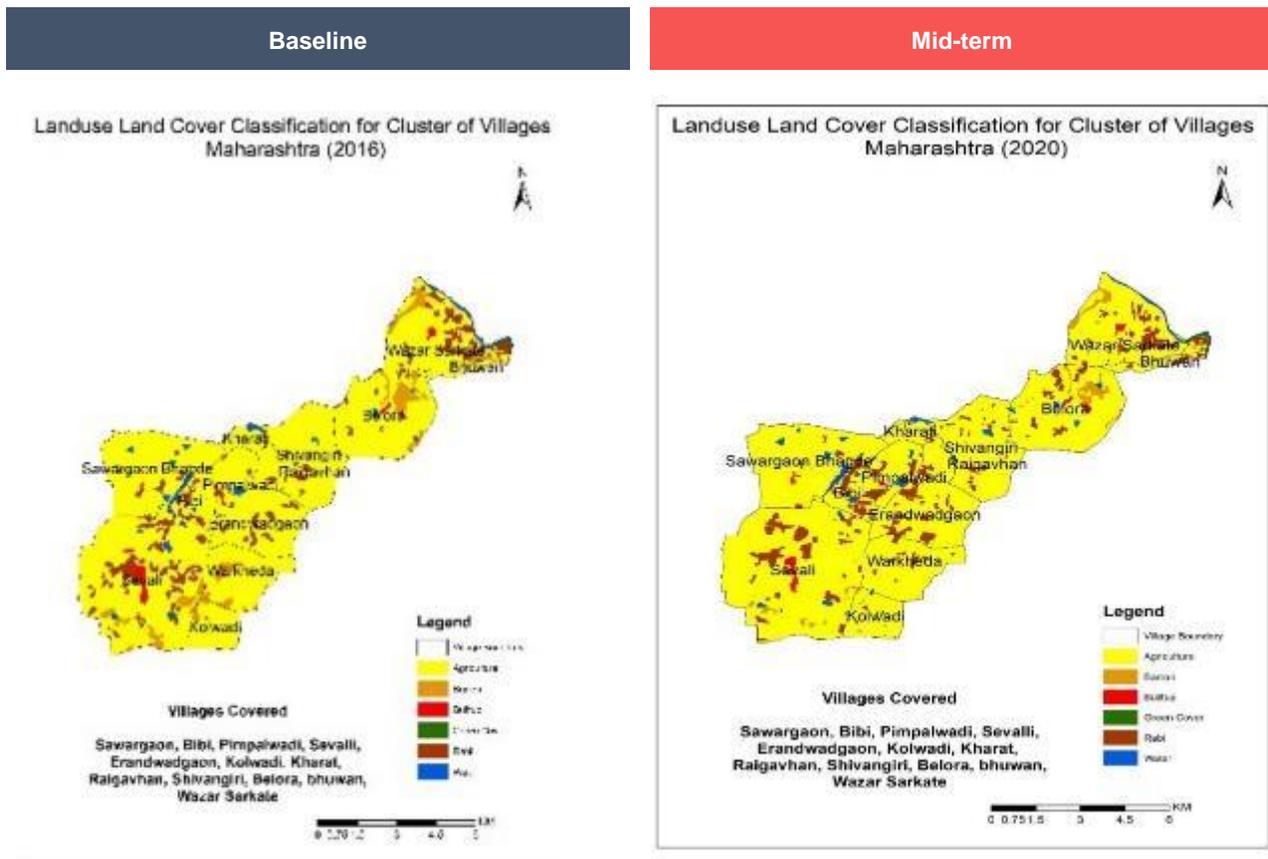
Table 46 Statistics of various classes for eight clusters

Class_Name	2016								Total
	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	
Agriculture	38.55	72.33	16.13	30.05	33.73	69.48	29.26	46.04	335.56
Barren	4.98	3.82	2.59	0.61	0.24	20.46	11.43	0.22	44.35
Built up	3.39	1.00	0.15	0.26	0.29	0.40	0.27	1.67	7.43
Green cover	0.02	0.08	10.64	0.00	0.00	2.78	4.34	0.00	17.86
Rabi	0.55	6.51	0.11	0.00	0.24	0.08	0.47	0.15	8.10
Water	0.72	1.62	0.21	1.58	2.48	1.96	0.92	0.63	10.12

2016									
Class_Name	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Cluster 6	Cluster 7	Cluster 8	Total
Agriculture	40.71	74.26	19.77	30.45	34.28	72.28	34.74	46.02	352.52
Barren	2.92	1.36	1.28	0.91	0.29	18.23	8.22	0.03	33.25
Built up	2.72	0.84	0.19	0.42	0.36	0.73	0.22	1.61	7.09
Green cover	0.09	0.15	8.36	0.01	0.00	1.99	2.08	0.10	12.77
Rabi	1.09	7.09	0.12	0.05	0.45	0.11	0.37	0.36	9.65
Water	0.69	1.65	0.15	0.73	1.59	1.82	1.05	0.58	8.27

**\*Area in sq. km**

It is observed that the total area under agriculture has increased from 335.56 sq km in 2016 to 352.52 Sq km in 2021 in eight clusters considered for the study. The area under Rabi season crop has increased by around 1.55 sq.km. It is also observed that nearly 10 Sq km of barren land has been reclaimed under agriculture. There has been slight decrease in both built up and surface water areas in these eight clusters. The LULC GIS maps have been given in the report.



## 5. Key Experts' Field Assessment

### 5.1 Field observations of Team Leader-cum-M&E expert

Purpose of Visit	MTR Field Assessment
Date of Visit (from – to)	26/12/2021 to 29/12/2021
Place of Visit	Aurangabad and field

During his three days visit, team leader-cum-M&E expert Mr. J.K. Sinha interacted with VCRMC members at Padli of Tehsil Khultabad and at Daregaon, visited Custom Hiring Centre, Farmers Field School and Zero Tillage Farming at Malegaon, and Shadenet at Padli and Malegaon. I also had meetings with district officials at Aurangabad.

#### **Interaction with Members of VCRMC Padli, Tehsil Khultabad**

The VCRMC- Padli has 13 members from two villages, viz Padli (10 members) and Sobargaon (3 members). Out of 13 members, nine are males and 4 are females. The VCRMC was established in 2018. There are 416 beneficiaries (340 from Padli and 216 from Sobargaon) covered under this VCRMC. This VCRMC has undertaken 230 drip irrigation, 13 farm-ponds and 3 inland-fisheries activities. Regarding Direct Benefit Transfer (DBT), there are 101 applications for water-pumps, out of which 23 disbursements were made. In sprinkler, 93 applications were received, out of which 9 disbursements have been done.

The VCRMC members and the local community have been demanding to re-start goatery and water pump distribution again as they got direct and immediate benefits from these activities. In livestock, they are demanding subsidy for milch animals (cattle and buffaloes). In infrastructure development, they are demanding storage for onion harvest.

When asked why the community prefers PoCRA when government subsidies are also available under different scheme, the VCRMC informed following benefits

- Quick disbursement of Subsidy – While in other government schemes it normally takes 2-3 years to get the subsidy amount, in PoCRA its rather quick where the amount is disbursed within weeks.
- Technical and Capacity Building Support – Another big difference is that the PoCRA not only help in quick disbursement of the subsidy, but also in building their capacities in operation and maintenance. For e.g., the residential training for Shade-nets.

#### Interaction with Members of VCRMC Daregaon, Tehsil – Khultabad

The VCRMC- Daregaon has 17 members from one village only, having 13 males and 4 females. The VCRMC was established in 2018. This VCRMC has undertaken 247 drip irrigation (out of 918 applications). In sprinkler, 56 applications were received, out of which 36 disbursements have been made. There were 117 applications for water-pump out of which 36 disbursements were made. There are 27 individual ponds in the VCRMC jurisdiction.

The VCRMC members and the local community have been demanding to re-start dug-well and water pump distribution again. They also suggested bee-keeping training for the interested beneficiaries.

#### Interaction with District Level Officials at Aurangabad

Mr. Sinha had a meeting with SDAO Mr. Subhash Agav; Project Specialist (PS)-Human Resource Development Mr. Vidyasagar Zubere; PS – Agribusiness Mr. Shankar Nirde; and PS – Agriculture Mr. Vishal Aglare.

The SDAO, Mr. Aghav has taken the charge hardly one month before (during December 1<sup>st</sup> week). I apprised him on my field visit as well as observations made during the visit. Our discussion focused on two aspects

1. Linking the beneficiaries with other government schemes
2. Provision of institutional credit to the beneficiaries

Mr. Aghav informed that while the PoCRA is focused on beneficiaries in selected project villages, other government schemes in agriculture have a very wide coverage, and all the farmers in the district are eligible for those schemes. Therefore, the spread is very thin. I told him due to close monitoring and hand-holding support in PoCRA villages the probability of success of those schemes is much higher. He agreed with my suggestion and informed that he would look into this aspect of linking PoCRA farmers with other government schemes.

Regarding linking PoCRA farmers with institutional credit, he informed him that though the subsidies are needed for the farmers to undertake activities with higher financial implications, the farmers need credit facilities on time. I also informed that District Level Bankers' Committee is there where this issue can be raised. I suggested him that like Vehicle finance is given against the collateral of the vehicle, the banks can also consider offering loan for shade-net, and other activities which need higher finance. He suggested that PoCRA team at district level can make a presentation to the bankers' committee on this aspect in their next meeting.

#### Key Observations and Recommendations

During his three days visit, he could observe how the PoCRA is impacting farmers' life and improving their livelihoods significantly. Besides having group meetings, he discussed in detail with some of the individual farmers which are presented as case studies. As most of the interventions are capital intensive, the farmers need financial support (grant, subsidy and/or loan) to undertake those interventions.

Another observation was that the farmers are focusing more on water utilization by harnessing surface and ground water resources. However, they are very little concerned about water harvesting, and improving water levels through soil-water conservation. Though the project has NRM interventions to address soil and water conservation, the farmers have shown negligible interest in undertaking those.

The following recommendations are made:

1. Promote farmers' linkage with other government schemes and institutional finance to sustain the project initiatives in climate resilient agriculture.
2. The project should focus on community level NRM activities towards conserving soil and water. In this context, probably a regulation can be made that those farmers who are applying for subsidy, should also undertake soil and water conservation measures in their field.

#### Case Study – Mahatma Phule Shetgari Gat/ Community Hiring Centre (CHC)

The village Padli has one Custom Hiring Centre with 14 members which provides tractor and equipment on rent. During the discussion with its Secretary Mr. Prashant Sanjay Kadam, it was learned that the members contributed Rs.14.5 lakh to buy a 50 HP tractor with trolley, rotovator, cultivator, pherni and other equipment. Upon submitting the bills/receipt for purchase, they received Rs.8.0 lakhs as subsidy from the PoCRA.

The tractor is given on rent to the interested farmers @Rs.1400 per acre. The farmers pay Rs.500/- onward for the trolley, depending on the distance and using time. In case of the members, they have only pay for the diesel to use the tractor and equipment.

On enquiring about the expenses and return, it was learned that the expenses include driver's and Secretary/Manager's salary, insurance premium, diesel expenses and repair & maintenance. Mr. Prashant informed that the CHC normally earn between Rs.5,000/- to Rs.7,000/- every month after deducting the expenses. Prashant is an Agricultural Graduate from Aurangabad in 2019.

#### Case Study 2 – Zero Tillage at Malegaon

Mr. Ashok Kashinath Gaikwad, a progressive farmer at Malegaon village is promoting zero tillage farming in his 1-hectare field at Malegaon. He used to undertake maize farming in this field, but due to high cost of cultivation and uncertain yield he switched over to zero tillage in 2021. He is cultivating Chickpea. As the crop is not harvested, he is not able to tell whether there will be profit or loss. However, he informed that

due to zero tillage the cost of cultivation was comparatively low (about 50%) as there was no ploughing needed. He put some weedicides only.

### Case Study 3: Shadenet

Mr. Mayur RaoSaheb Kadam is a young farmer, about 25 years of age. He recently graduated in Agricultural Engineering from Pune. Though, he got job through campus placement, but rather came back to his village to do the farming. He met Cluster In-charge, PoCRA Mr. Kalyan Vijay Aghade who encouraged him to take farming through Shade-net. The total cost of the Shade-net was Rs.22.8 lakh (4000 sq metre) out of which he received 75% as subsidy from the project. Last year, he cultivated Shimla Mirch (Capsicum), but due to sudden glut in the market he lost badly. He said his cost of cultivation was about Rs.80,000/- but he was able to sell the produce only at Rs.40,000.

At the time of my visit, he was cultivating Cucumber. When asked about the cost of cultivation, he gave following break-up for 400 sq metre area.

- Seed Cost- Rs.40,000/-
- Mulching – Rs.15,000/-
- Labour – Rs.20,000/-
- Fertilizer – Rs.10,000/-
- Plant medicine – Rs.15,000/-
- Total Rs.100,000/-

He said that the trader has offered him Rs.1600/- per quintal and he is expecting 180 quintals cucumber from his shade-net. As such, he expects Rs.1600 x 180 = Rs.2.88 lakhs gross income. After deducting the cost of Rs.75,000/- he expects a net profit of about Rs.1.78 lakhs.

While enquiring the main challenges, he said the pests and diseases, uncertain market prices and high cost of inputs are the main issues which he has been facing.

Mayur and Prashant are considering promoting a Farmers Producer Company (FPC) by bringing other farmers from his villages. They said that FPC gets certain benefits from the government, as well as the collectives of the farmers will put peer pressure on input providers and marketing agent to offer them fair price.

## 5.2 Field observation of Agri-Economist

During the second week of November 2021, four villages namely Gandheli and Adgon Badru in Aurangabad district and Tapovan and Tupewali in Jalana district were visited. The purpose of the visit was to understand mid-term impact of PoCRA intervention keeping in view economic aspects of project activities at farm level. The present discussion has been grouped into six sections such as first farm practices; second, cost structure of major crops, third performance of sericulture, fourth project activities implemented, fifth, social implications and sixth concluding observations and suggestions.

The participatory approach such group discussion, interaction with the project implementation staff at field level and senior management staff was followed to collect the information regarding impact of project activities at ground level and to identify problems in project implementation.

### 1. Farm Practices

In the present section, an attempt has been made to work out the economics of crop cultivation under different practices.

1.1 Cropping Pattern: An attempt has been made to understand about the cropping pattern adopted by the farmers in project area. Before the project intervention, the farmers were sowing major crops during kharif season including cotton, moong, maize, soyabean and tur. During kharif season the farmers were growing wheat, gram and rabi Jowar. After the project intervention, almost similar cropping pattern was followed

with changing area under respective crop. There was a substantial decrease in area under cotton crop. The respondents informed that the area under moong, maize and tur was reduced by 33, 50 and 20 percent respectively, as compared to the situation before the project. The area under rabi season crops has also been reduced considerably i.e., about 50 percent in case of wheat and gram crops and 25 percent in case of rabi bajra. After the project new crops were emerged such as horticulture crops including vegetables (Table 38). About 40 percent of the total cropped area was allocated to the new crops including vegetables and so on. The decrease in area under fodder crop was less than that of other crops. It shows that farmers allocate the area to fodder crop keeping in view the demand for fodder to their animals that farmers rear.

Table 45: Cropping Pattern Followed by the Farmers Before and after the Project

Before the project		After the Project
Crops Grown	Crops Grown	New Crops Emerged
Kharif: Cotton, moong, maize, Soyabeen, Tur and so on.	Kharif: Cotton (-75%), moong (-33%, maize (-50%), Soyabeen (0), Tur (-20%) and so on.	Chill, Tomatoes, Capsicum, Cucumber, turmeric, and other cash crops
Rabi: Wheat, Gram, rabi juari	Rabi: Wheat (-50%), Gram (-50%), rabi Jowar, Bajra (-25%)	

**Crop Productivity:** Crop productivity is one of the major indicators of development in farm economy. After the project, there was substantial increase in productivity of major crops grown by the farmers. It can be due the fact of the adoption of recommended crop technology, adoption of required inputs and availability of water for irrigation after the project intervention. No double, area under cotton crop has been decreased considerable but the productivity has been increased by about 67 percent. The productivity under wheat, gram and rabi juari was substantial. While this increase was noted as one-third and more than that in case of other crops (Table 39).

Table 47 Changes in Crop Productivity (Q/Ha.)

Crops	Before the project	After the Project	Proportionate (Percent) Change
Cotton	11.25	18.75	66.67
Moong	7.50	10.00	33.33
Soybean	10.00	13.75	37.50
Groundnut	7.50	10.00	33.33
Tur	15.00	20.00	33.33
Wheat	11.25	21.25	88.89
Gram	10.00	17.50	75.00
Juari	15.00	37.50	150.00

Source: Field observation

## 2. Cost Structure of Major Crops

An attempt has been made to work out the economics of different crops grown under different techniques followed by the farmers. These techniques include (i) traditional practices used for cultivation of food and non-food crops, (ii) Shade net intervention that is followed in vegetables and floriculture cultivation, and (iii) Inter-cropping practice.

(i) Cultivation of Traditional Crops: The present section deals with the economic aspect of cultivation of major crops during both kharif and rabi seasons. These crops include wheat, tur, bajra /juari cotton, soybean, vegetables, and floriculture. It is noted from the fact that cost and returns in case of traditional crops were not much different with certain exceptions. The farmers were growing these crops keeping in view the requirement of food and fodder for human and animals. It can be noted from the fact that cost structure in case of wheat, tur, cotton, and soybean varies between Rs.20 thousand to about Rs.22 thousand except for fodder crop. Almost, similar pattern can be noticed in case of revenue earned from the crops. The net returns from these were Rs.34 thousand in case of wheat, Rs.14 thousand for wheat, about Rs. 20 thousand for Tur and cotton Rs. 22 thousand for oil seed crop such as soybean was earned by the farmers (Table 40).

(ii) Shade Net Intervention: The provision of Shade Net is one of the most important intervention activities under PoCRA<sup>30</sup>. Shade Net activity helps in maintaining required sunlight, moisture, and air for the proper growth of the plants. In the project area, the farmers use it for cultivation of cash crop such as vegetables and floriculture. Being a capital-intensive activity, it is highly subsidised i.e., more than 75 percent. It is noted from the fact that the farmers were growing cash crops such as vegetables and floriculture. The vegetables crops include capsicum, cucumber, muskmelon, and floriculture especially marigold.

The analysis shows that total average cost that incurred in cultivation of capsicum was about Rs. 2.68 lakh per hectare while the average revenue was worked out as about Rs.6.56 per hectare. Hence, per hectare average net returns were around Rs. 3.88. In case of marigold cultivation, per hectare average cost was about Rs. 1. 18 lakh and total revenue was Rs. 3 lakh and farmers were getting annual average net returns about Rs.1.82 lakh. In case of overall cultivation, the average annual net returns were Rs. 5.70 lakh that is substantial as compared to other farm practices followed by the farmers (Table 40). Further, analysis shows that in cultivation of cash crops during the year, human labour component constituted a major share as one-fourth in total cost followed by seed and crop nutrients such as Farmyard Manure (FYM) and chemical fertilizer. It was found that the farmers apply FYM once during the crop year<sup>31</sup>.

Table 48 Cost of production of Major Crops (in Rs.)

Particulars	Major Crops						
	Wheat	Tur	Bajra	Cotton	Soybean	Vegetables	Floriculture
Labour Cost							
Machine	3500	3600	1500	1500	1100	16000	10667

<sup>30</sup> During the field visit, it is noted that shade net is one of the important project activities. The farmers have shown keen interest to be associated with this intervention. The farmers from the non-project area shown the keen interest in this intervention and were demanding to expand project area. It is the demonstration effect of the PoCRA that can be seen in the field.

<sup>31</sup> It was noted during the discussion with groups of farmers across the villages.

Particulars	Major Crops						
	Wheat	Tur	Bajra	Cotton	Soybean	Vegetables	Floriculture
Animal	0	1500		2000	2000	4667	4267
Human	2500	3000	200	6000	5000	53333	40000
<b>Material Cost</b>							
Seed	2000	300	400	1500	4500	38000	20000
Fertilizer	400	3600	500	4400	2800	33333	4000
FYM	1200	0	0	0	1500	40000	0
Pesticides/ Insecticides	2000	3000	0	2000	1700	23333	2000
Irrigation	1667	1500	300	500	500	8000	2667
Harvesting	2000	1500	1500	0	1800	12667	9333
Packing Material	1500	700	450	300	300	20000	12000
Transportation Cost	1600	560	800	800	900	16000	9333
Marketing Cost	1500	750	150	1500	250	2500	3500
<b>Total Cost</b>	<b>19867</b>	<b>20010</b>	<b>5800</b>	<b>20500</b>	<b>22350</b>	<b>267833</b>	<b>117767</b>
<b>Total Revenue</b>	<b>34000</b>	<b>39900</b>	<b>10800</b>	<b>40000</b>	<b>42000</b>	<b>656000</b>	<b>300000</b>
<b>Net Returns</b>	<b>14133</b>	<b>19890</b>	<b>5000</b>	<b>19500</b>	<b>25550</b>	<b>388167</b>	<b>182233</b>
<b>Input-Output ratio</b>	<b>58:42</b>	<b>50:50</b>	<b>54:46</b>	<b>51:49</b>	<b>53:47</b>	<b>41:59</b>	<b>39:61</b>

Source: Field Observation

It is revealed from the analysis that cultivation of other cash crops during the year yielding substantial net returns as compared to that of traditional crops. In the cultivation of these crops such as vegetables and floriculture, the project interventions in term of net-shed infrastructure have played a significant role developing the agricultural economy in the project area. In the cost of cultivation, human labour component constituted major share in total cost of production. Because of the shade net activity of PoCRA, the farmers were able cultivate high value crops.

Further, it can be noted from the fact that there is no systematic input-output ratio among the different crops. Keeping in view the viability of shade net intervention, the farmers were demanding for more support of this activity. They also expressed that the provision of shade net activity should be more comfortable so that the left-out farmers can be benefited. It can be stated that knowledgeable and progressive farmers those

have the management capacity were found to be benefited considerably from this intervention<sup>32</sup>. The farmers reported that because of pandemic, they faced certain problems especially relating labour and marketing.

(iii) Farm Practices and Adoption of Technological Options: Under project interventions, there are various technological options for crop production to make the agricultural practices climate resilient as well as minimising the production cost of different crops. In this section, an attempt has been made to understand the role of various technological options on the cultivation cost of various crops. It is emerged from the discussion with different farmers' groups in the project villages that various farm techniques were followed by the farmers which has strong implications on the cultivation cost of various crops. During the field visit, it was noted that the farmers were following the inter-cropping practices on the limited size of land. The inter-cropping practices were not new but age old. The farmers were following to minimize the environmental risks. Today, these practices are being followed by the famers in a scientific manner. As per the farmers' priorities, institutional and technical, they were following inter-cropping practices. Under these practices, the farmers were following the combinations of Soyabeen+ Tuhar, Cotton+Soyabeen, Maize+ Cotton+Moong, and so on (Table4).

The analysis shows that in case of onion cultivation, the farmers were getting quantum of benefits as compared to other crops. Certainly, it is because of the PoCRA's support in terms of micro irrigation include drip and sprinklers as well as water tanks that ensure irrigation facilities. Similarly, in case of other combinations of crops, the extent of benefits was considerable. Next to onion cultivation, the benefits of Chilly seed production were also considerable. It is important to mention here that separate estimation of cost of production was complex and therefore, it is ignored in the present context (Table 4). The adoption of cultivation practices such as keeping appropriate gaps in rows among different crops keeping in mind the varieties of crop as well as sowing and maturity timings. The innovative ideas and practices that the farmers in project villages were following efficiently was the outcome of the Farmer Field School (FFS). Hence, the performance of institutional intervention can also be noted.

Table 49 Cost of Cultivation of Selected Crop Combination in the Project Villages

Particulars	Soybean+ Tuhar	Cotton+ Soybean	Maize+ Cotton+ moong	Traditional Practices	Zero Tillage	Onion	Chili seed
<b>Labour Cost</b>							
Machine	1600	3125	2571	6250	2250	15000	4500
Animal	1067	1500	2143	3250	880	1500	1875
Human	1600	14286	22143	16200	8745	17500	62500
<b>Material Cost</b>							
Seed	1227	1313	1750	2625	3500	25000	6250
Fertilizer	2800	1813	1250	3625	2500	11250	20000
FYM	1333	0	1500	500	750	7500	5000

<sup>32</sup> It is observed during the interaction with the groups of farmers in the project villages. Only those farmers were getting benefits those have enrich in broader understanding about the modern agriculture operation.

Particulars	Soybean+ Tuhar	Cotton+ Soybean	Maize+ Cotton+ moong	Traditional Practices	Zero Tillage	Onion	Chili seed
Pesticide/ Insecticides	2667	1875	3750	2850	2480	3000	45000
Irrigation	6667	2500	4000	1250	1475	12500	10000
Harvesting	2480	2800	3211	2670	3500	9865	5600
Other	1867	2750	3750	860	990	750	6250
Total Cost	23308	31962	46068	40080	27070	103865	161375
Total Revenue	81000	95625	94286	72800	84000	280000	312500
Net Return	57692	63663	48218	32720	56930	176135	151125
Input-Output ratio	29:71	33:67	49:51	55:45	32:68	37:63	52:48

Source: Field Observation

The zero-tillage technology has also played crucial role in bringing down the cost of crop cultivation and resource conservation. It is observed that the farmers were showing interest in zero tillage technology. Initially, the farmers were reluctant to adopt this technique due to certain considerations like appearance of field at the initial stage. But as the zero tillage crops grows and matures effectively, it created the interest of the farmers because of both quality and productivity of zero tillage crops. The available technological options not only helped in increase the crop production but also contributed considerably to bringing down the production cost and resource conservation, helped increasing crop productivity, cropping intensity and helped improving soil health<sup>33</sup>.

It is observed during the attraction with farming communities and other stakeholders that the farmers were more concerned with attaining maximum and possible profits rather than usage of resources in a sustainable manner. Hence, the ultimate objective of the project is missing. Farmers' priorities were to enhance the profitability from the limited land resources<sup>34</sup>. To deal with such strategies of the framing communities, there is need to strengthen the capacity building programme so that project intervention can be made climate resilient.

The analysis also shows that input-output ratios reflecting the extent of viability of different crops cultivated by the farmers. In the present context, there is no systematic pattern in input-output ratios across the crops. Certainly, it will help in taking the decision while applying the farm inputs keeping in view the resource contains.

### 3. Performance of Sericulture

Generally, it is viewed that agricultural sector alone cannot provide viable solution to deal with the problem of rural poverty. Hence, sericulture, the production of silk has become a promising to resolve issue of rural activity because of its minimum gestation period, minimal investment and maximum employment potential

<sup>33</sup> This experience shared by the groups of farmers during the discussion. The similar experience also shared by the project staff deployed at the village level.

<sup>34</sup> This experience was shared by the project implementing staff. Some of the farmers also reported that same.

and quick turnover for investment. Similarly, sericulture activity was added in PoCRA's program. To understand the performance of sericulture activity, two villages namely, Taki Sagar and Sonari in Aurangabad District were considered. In these villages about 12 farmers were linked with activity. In Sonari village about four farmers either left out or did it seasonally. It was because of the two factors such as (i) involvement of farmers in farm and livestock-based activities and (ii) seasonal variations in the feed supply due to natural factors. The analysis shows that the total average cost of mulberry farm establishment was about Rs.49 thousand per annum. The estimated cost consists of input cost such as human labour, animal labour, FYM, chemical fertilizers, irrigation, and interest on working capital<sup>35</sup>.

An attempt has been made to work out the economics of silk cocoon production in the selected villages and among the beneficiary farmers. In sericulture sub-sector, output of farm is the input of sericulture. In this enterprise farm production constitutes the major share i.e., about 48 percent followed by cost of cocoon with two-third share. The shares of other components such as transportation and labour were 4 and 5 percent respectively (Table 40). Usage of fungicide and packing material was less than one percent. The per farm average total cost was worked out as about Rs. 95 lakhs and total annual average revenue was about Rs. 1.73 lakhs. Hence, the net return per ha/year was around Rs.78 thousand and input-output ratio was worked out to be 55:45. It can be inferred that the sericulture intervention in PoCRA is viable.

*Table 50 Average Cost of Production of sericulture in the Selected Villages*

Particulars	Per Household	Share to Total Cost
	Average Cost (Rs.)	(Percentages)
Cost of leaf (ha/year)	49416	51.99
Labour Cost	8333	8.77
Fungicide	800	0.84
Cocoon cost (ha/year)	32500	34.19
Packing Cost	750	0.79
Transportation Cost	3250	3.42
Total Cost	95049	
Gross income (ha/year)	172600	
Net benefits	77551	
Input-output ratio	55:45	

Source: Field observations

#### 4. Project Activities Implemented

Under the provisions of PoCRA, certain activities were planned and implemented in the project villages at first and second phase. These activities include sprinkler, drip, motor pumps, FES, PVC pipes farm ponds, farm implements including tractors and other implements, farm ponds, fruit plants and so on. Because of certain constraints during the implementation of the project activities, the concerned authority has

<sup>35</sup> See for details Concurrent Monitoring and Evaluation Report Round V, Nanaji Deshmuk Krushi Sanjivani Prkalp, Mumbai

withdrawn certain activities. It not only hampered the project activities but also affected the expected beneficiaries. The farmers reported that some of the activities have been closed down like community ponds, motor-pumps. It may be due to certain possibilities of irregularities in the proper implementing of project activities in some villages. On this ground, it is not desirable to stop the activities in all project area villages. The farmers also reported that the authority should take the area specific decision rather than all over the project. They also reported that certain activities of the project are capital intensive. The evidence shows that Insurance Companies were reluctant to be involved in insuring the expected risk. The farmers also expressed that immediate requirement of certain guidelines for the insurance companies<sup>36</sup>. Further, it also came in the notice that due to location of fields under high transmission lines, the insurance companies also escape from the job. The government should give attention to resolve the farmers’ problem on priority basis.

### 5. Social Implications

In this section, an attempt has been made to understand the perceptions of the farmers on some social issues. It includes allocation of income earned from the agriculture sector and its further allocation to different purposes, usages in the household, migration human resource and gender related implications.

Usage of Farm Income: It is found that most of farmers i.e., about 80 percent reinvested farm income in farm-based activities in terms farm inputs, land development activities and so on. Interestingly, they gave priority to educate their children in good institutions and higher education<sup>37</sup>. It is found that the farmers were under heavy indebtedness since long time. After the project implementation, they earned good amount of farm income. It was reported that about half of the farmers were repaying loan. About one-fourth of the farmers were purchasing the household assets. Only 6 percent of the farmers were investing their farm income in livelihood-based activities such opening of shops, small industrial units and other non-farm activities. A limited proportion of the farmers i.e., only 2 percent were using the farm income in social ceremonies (Table 5).

Table 51 Farmers’ Perceptions about the investment of Farm Income

Types of Activities	Proportion (Percentage) of Households
Agriculture Based	80
Livelihood	6
Purchase of HHs Assets	25
Education	75
Repayment of Loan	50
Social ceremonies	2

Source: Field observation

Migration: PoCRA has strong implications on migrations of labour within and outside the villages. The migration from the project villages has been absolutely stopped. There was a substantial demand for labour for accomplishing the farm activities across the crop seasons. Hence, there was considerable migration

<sup>36</sup> Some of the farmers in Gandheli village in Aurangabad district reported that there is always threat of any unforeseen incidents on the farm. Therefore, it is urgent need to links the farmers with insurance companies.

<sup>37</sup> Farmers reported that largely, the farmers send their children in the cities for higher education.

from non-project areas to project villages<sup>38</sup>. It can be stated that out migration due to livelihood compulsions of the households from the project villages has been reduced.

Gender Implications: There are various gender implications that helped a lot in empowering the women in the project areas.

- To become the beneficiaries of PoCRA, the farmer should be marginal and small size of categories. Therefore, the farmers beyond these categories, they change the ownership in the name of female counterparts. It helps in empowering them. It was reported by the groups of farmers that in the villages Jalana district, 50 to 90 percent of the households have transferred their land to the female members of the family<sup>39</sup>.
- Because of growing demand for labour in certain labour-intensive crop cultivation, in most of the cases members of a family including wife and husband as well as other males and females go for wage employment outside the village. It ensures the social security among them. Because of the employment to both male and female make them adjustable in wage differences<sup>40</sup>. But the wage discrimination was noticed across the villages<sup>41</sup>.
- The women participation in sericulture activities was noticeable. In proportionate term, it was 62 percent of total labour deployment in sericulture-based activities. They are occupying the leading position in all components of labour except physical work like installing and maintaining the structure and marketing activities<sup>42</sup>.

## 6. Concluding Observations and Suggestions

The foregoing analysis and discussion highlight some meaningful insights that can be useful to draw some suggestions.

6.1 Concluding Observations: The major conclusions that emerged from the foregoing discussions are as follows.

### Farm Practice

- After the project implementation, the area under traditional crops such as cereal and oil seeds have decreased considerably. The new cropping pattern that is considered as cash crops including tree fruits,

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<sup>38</sup> In the villages, where labor intensive crops were grown, about 250 females and 350 females come to the villages as farm labour.

<sup>39</sup> It was emerged during the FGD held in the villages of Jalana district. It was pointed out that there were considerable changes in land ownership in favors of females to become the eligible for getting the benefits of PoCRA.

<sup>40</sup> It was found that there were wide variations in wage rates among men and women. The women get lower wages rate as compared to men counterparts. In such situation, they get adjusted and compensated that both of them are getting employment.

<sup>41</sup> The people reported that gender discrimination was because of the social consideration and prevailing practices in the society.

<sup>42</sup> See for details in Concurrent Monitoring and Evaluation Report Round V, Nanaji Deshmukh Krushi Sanjivani Prakalp, Mumbai

vegetables and other fruits has been emerged. More than 40 percent of the total cultivated by has been shifted to new emerged cropping pattern<sup>43</sup>.

- After PoCRA intervention, the labour- and capital-intensive cropping pattern has been emerged. It resulted in expansion of demand for labour considerably. It helped a lot in resolving the unemployment issue in the rural project and non-project areas. A substantial expansion in horticulture crops resulted in increase of requirement of irrigation water. To meet the growing requirement of irrigation water, there is a need to provide the facility of community ponds on the priority basis. Certainly, it will be useful for marginal and small sizes of farms to intensively practise farming on limited size of land.
- The input-output ratios providing the interesting scenario to understand the viability of the crop-cultivation. There is no systematic pattern in input-output ratios. There is a need to give due attention towards the economic aspects at project level.
- The expansion in crop productivity also giving the encouraging outcome at farm as well as at project level. The productivity in case of all crops increased with varying rates. These changes in case were lower in case of seed and pulses crops while these estimates were considerably higher. Interestingly, in case of some crops the area has been increased considerably while productivity has been improved considerably that may be due to assured irrigation and other input application.

#### Farm Practices and Adoption of Technological Options

- The availability and access to the various technological options to the farmers have contributed considerably to farm production. It is observed during the field visit that the farmers remain in experiment mode always. In other words, they were ready to follow the innovative techniques at the farms. Also, noticed that the awareness about the project interventions has been increased substantially among the farming community. It can be because of the institutional support and demonstration effects at both farm level and project levels.
- It is observed during the interaction with the farmers that they were more concerned to attain maximum possible profits from limited size of holding. Thus, there is possibility of diversion from the ultimate objective of the project i.e., climate resilience. Hence, it can be pointed out that there is a need to focus on capacity building program that can be helpful in resource conservation rather than resource exploitation.

#### Project activities Implemented

- It is found that some of the activities such as pump sets and motor pumps are closed down. It is because of the certain problems in the program implementations at village level. But some of the interested farmers were deprived from the facilities provided under PoCRA. Largely, the farmers were of the view that closed down facilities should be reinstated so that deprived as well as neglected farmers can be benefited. Besides, some flexibility is also required while sanctioning of the activities in the village level.

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<sup>43</sup> This fact has been emerged during the discussion with groups of farmers in the selected villages. The findings of the analysis have been presented in section 1 of the present study.

- Limited attention has been given to install the playhouses. It is also emerged during the discussion that in the absence of required intervention under the project, banking system should come forward and support the required activities in the project area.
- Limited attention has been paid to the provisions of institutional reforms especially in case of marketing of farm produce. In other words, regulate marketing facilities were found inefficient that caused to high transportation. The facilities of storage were also found inadequate<sup>44</sup>. Experience shows that absence of these institutional and infrastructure cause to tension among the farming communities. The absence of effective arrangement adversely effects the viability of crop production.
- The presence of insurance companies is absolutely missing to insure the capital-intensive infrastructure constructed under PoCRA. The community realised the importance of insurance companies to deal with the expected risk.

### Social implications

- Farmers were found to be investing on productive activities utilising farm income. The farmers were focusing on improving education level of the family member by sending them to a good education institution, even for attaining higher education. It can be inferred that the social capital has been improved and strengthened which has helped in meeting the social goal of the project.
- In the project areas, there is a trend to become eligible for getting the benefits of PoCRA. Hence, the farmers have found out the ways to fall in the categories of marginal and small sizes of farmers. The farmers distribute the land among the female members, mostly with wife. Hence, the land is distributed within the households, and they fall in the categories such as marginal and small farm sizes and become the beneficiaries of PoCRA. This has brought desirable results in empowering the women in farm economy.

**1.2 Suggestions:** On the basis of discussions with the farmers and observations, certain suggestion can be put forth that would be helpful to meet the ultimate objectives of the intervention.

- I. **Need of Policy Review:** Keeping in view the farmers' interest and growing demand for certain project activities that are closed. In this regard, the policies can be reviewed. These activities can be restarted with effective monitoring at various levels so that deprived farmers can be benefited. There is a need of certain institutional reforms which can be useful in supporting the project activities and beyond that such as active participation of financial institutions at farm levels. Hence, review of prevailing and related policies is highly needed.
- II. **Capacity Building Program (CBP):** The success of any development initiative depends upon the capacity building of various stakeholders. The capacity building program can be initiated at individual and institutional levels. Under this project, the training programme for beneficiaries is essential. It can be in terms of workshops, seminars, training, and exposure visits. The capacity building programme were organised efficiently that covered different issues and changes faced by the farmers and project implementing staff. Certainly, it is desirable to organise the CBP for the beneficiaries so that they can understand about their farm actions and their relationship of the

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<sup>44</sup> It was noted interaction with groups of farmers in different villages that limited efforts have been made. Largely, they realized that marketing and storage facilities should be priority of the project. They reported that if due attention would be paid on these aspects. Certainly, farming activities will be more viable.

environment. Otherwise, PoCRA type of intervention may not bring the desirable results. In capacity building programme, the involvement of KVKs, universities, research institution as well as specialised NGOs should be encouraged.

- III. **Need of sound marketing Facilities:** There is a need to develop market centres at the village and cluster of villages. This will help in minimizing transport cost incurred on farm produce on the one hand and justified price of the same on the other. To establish a strengthened agricultural market system, there is a need to constitute the farmer's groups at various levels such as village, block/ talukas and district and beyond. Therefore, there is a need of certain reforms at market issues. These reforms should be in favour of farming communities. It is essential to avoid the expected tensions among the farming communities. The government should give due attention towards these aspects.
- IV. **Linkages with Insurance Companies:** As it is emerged that some activities under the project area are capital intensive. In such cases, provision of insurance of these activities is essential to deal with the unforeseen risk. Therefore, it is essential to make the provisions so that farmers can avail insurance facilities.
- V. **Minimisation of Gender Discrimination in Wage Employment:** The wage discrimination in case females is common phenomenon in the agriculture sector. No doubt that it is social issue, but certain efforts can be made through raising the in-capacity building programs at various stages.

### 5.3 Field observation by Agribusiness expert

Agribusiness expert Mr. Deodatt Singh visited 2 self-help groups (SHGs) and 2 Farmer Producer Companies (FPCs) from 29<sup>th</sup> to 30<sup>th</sup> November 2021 in Jalna district.

The objective of the visit was to provide feedback on the below mentioned parameters:

1. Socio-economic impact of an agribusiness project on members of FPC/SHG
2. Investment in and return from an agribusiness project undertaken by FPC/SHG
3. Sustainability of agribusiness undertaken by FPC/SHG
4. Resilience in agricultural system achieved through agribusiness project undertaken by FPC/SHG

Detail of Self Help Groups visited:

- 1) Name and details of SHG: Summrudhi – situated at Tupewadi, Badnapur, Jalna, Contact person : Mr. Baban Sirale

This one year old SHG has 22 members (14 male and 8 female members) and each member contributes Rs. 500 per month to SHG. The SHG has established farm machinery bank using the grant amount INR 1153800/- received under PoCRA project and also using their own savings of around Rs. 10 lakh.

The SHG has purchased tractor, trolley, seed drill, plough, multicrop thresher and some other small farm equipment to provide to farmers on rent. The SHG rents out the equipment to both members and non-members of SHG. but the priority is given to the members. The members of SHGs grow cotton, moong, soybean crops and sell these in the market. They are also engaged in seed production of Chili, Tomato, Bitter Gourd, Brinjal and Cucumber for seed companies. The SHG has pre-decided rates for renting out each of the equipment. eg. Tractor with plough is rented at the rate of Rs. 1100 per acre.

- 2) Name of SHG: Srikrupa Shetkari Ghat

This three year old SHG has 12 members (9 male and 3 female members) and each of its member contributes INR 100 per month.

The SHG has established a storage house on leased land. The lease is for 20 years at the rate of INR 6000/- per month. The total investment in constructing storage was around Rs. 28 lakh which partially came from PoCRA grant and savings of SHG. The purpose of the storage built is for storing agriculture commodity

mainly cotton. At the time of visit the store was rented out to a drip irrigation company for storing drip equipment.

Observations:

- With the start of new business, income of the members increased and that led to increase of saving contributed by its members to the kitty of SHG.
- The additional income earned by the members helped improvement in nutritional status of the family.
- Few members invested additional income in setting up digital access to online school for their children. Members bought smart phones for the family.
- The members felt that their participation in the decisions of the family has increased because the confidence of the members in the family their capabilities have increased since they exhibited their capabilities by initiating and successfully leading new business through SHG.
- The members feel more confident because of power of collective. They are more articulate in presenting their business case and future ideas. Members have their short term and long term vision.
- Members feel that their awareness on social issues has improved, and they are able to participate in gram sabha meetings with better preparation and they are also able to contribute in a more constructive way.
- Members reported that their ability to access credit specially from bank has not improved. Banks still do not consider SHGs as a reliable collective to offer loans. But overall decrease in indebtedness was reported by the members.
- The SHGs started making very little profit and hence RoI could not be calculated. In a rough estimate RoI of SHGs is around 3%.
- The business has started well but to make it sustainable certain level of efficiency is yet to be achieved. Eg- Farm equipment rental and space utilization at store needs should be optimized. The certain level of efficiency can be achieved by engaging technology for resource optimization.
- The improved access and use of farm equipment has helped farmers mitigating seasonal fluctuations caused due to climate change.
- Members reported increment in production by 4-5%.
- Members also reported improvement in saving and overall income.
- Engagement of farm machinery has also decreased drudgery of labour involved.

Recommendations:

- SHG members lack technical expertise of repair and maintenance of the farm equipment and are dependent on outsourced mechanics. The in-house capacity can be built within SHG members to save time and money.
- SHG members need training on account bookkeeping and good business practices.
- Addition of more equipment like small harvester can be added to the portfolio of farm machinery bank.
- Long term vision building exercise should be conducted among SHG members to build their long term perspective and help them identify their Strengths, Weaknesses, Opportunity and Threats.

Detail of Farmer Producer Companies visited:

1) Jeevrekha Agri-producer Company Limited, Ganeshpur

Registered in: 2014

Number of Directors: 5 (4 male and 1 female)

Members: 380 (305 male and 75 female) General-253, OBC-56, SC-5, ST-65.

Membership fee: INR 1000 per member

Activity/business: Godown and processing unit (cleaning and grading of Tur, Soybean, Wheat and Jowar)

2) Khadeshwar Farmer Producer Company, Banegaon

Registered in: 2017

Number of Directors: 11 (10 male and 1 female)

Members: 1243, General members-50%, OBC-11%, SC-35%, ST-4%.

Membership fee: INR 1000 per member

Activity/business: Godown and procurement of Maize

#### Observations:

- Directors and members of both the FPCs are highly motivated as they have invested the seed money in the company.
- The trust between Directors and members is very strong mainly because lot of business transparency is reflected in the minutes of the meetings.
- Directors have very clear short and long term vision but clarity at member level is little low.
- Both the FPCs have very clear future plan (want to explore organic business and establish their own brand and market channel) but that is neither documented nor reflected in business plan.
- Business plan is very basic and doesn't include risk and mitigation strategy. Different business scenarios are also missing from the business plan.
- Availability of credit is the biggest pain point of the FPCs. Directors lack capacity of building a bankable business proposal.
- FPCs see Climate change as the biggest challenge to their livelihood in the future. Members are encouraged to adopt climate resilient practices and technologies, eg. Inter cropping and use of Bio-char. Members also get weather information from the locally installed weather stations to take real time farming decisions enabling farmers to take climate resilient decisions.
- FPC aggregates input requirements from the members and purchases it from the market in the bulk. With sizable demand FPCs negotiate good price with the vendor and ultimately members get benefit.
- The procurement rate of the output is always higher (by 8-10%) than the market price for the member farmers. That is the biggest pull factor for the farmers to join the FPC as member.
- Members of the FPC have better access to crop loan as compared to non-members.
- With increased income, farmers are in a position to take informed decision on adoption of improved agriculture practices.
- Farmers are taking responsible decisions for environmental protection and they care natural resources especially soil and water. Eg. Farmers are willingly taking decision to reduce chemical load and are turning towards sustainable/organic farming.
- Overall quality of members life has improved - with the improved income (mainly because reduction in cost of cultivation and net realization of output marketing) they are able to invest more in health, education and nutrition of the family.
- Although there is representation of women in the board and members but they did not have equitable representation. To make FPCs more inclusive representation of women, differently able persons, single women and widow should be encouraged.

- Women membership should be given priority and conducive environment in the FPC should developed so that more and more women become part of the company.

Recommendation:

1. FPCs have started well but now desperately need handholding support/mentor-ship to take their business forward. Other than business trainings, FPC members require capacity building inputs on their core activity. Eg. FPC handling storage should get training of warehouse management, Pest management and stock keeping etc. An App based technical repository can be created which can be accessed by the members of FPCs for developing their capacity virtually.
2. Engaging technology solution for demand aggregation and output marketing can be explored. A digital platform for input demand aggregation and output selling should be developed and all FPCs supported by PoCRA should be given access.

## 5.4 Field observation by Agronomy expert

The objective of the field visit was to assess the impact, constraints if any and the status of implementation of the Project on “Climate Resilient Agriculture (PoCRA )”. Dr R. B. Singandhupe (Agronomy Consultant) and Shri Dalbir Singh ( socio economic consultant ) visited two districts viz. Aurangabad and Jalna districts in Aurangabad Division , Maharashtra during 27 and 28th October , 2021. After the field visit, they attended the meeting on findings of Concurrent Monitoring-Von 29.10.2021 at PoCRA PMU office at Mumbai and discussed on the project outcomes, issues / constraints with the officials of the PoCRA, Sambodhi Research and Communication / TERI and finalized further mode of action so as to enhance the activities of the well - established and economically acceptable technique in non- adopted villages in subsequent phases of the project.

Cropping pattern, climatic / soils and natural availability scenarios of Aurangabad district:

The major kharif crops of this district are cotton, soybean, red gram, Jowar, green gram, black gram, pearl millets and maize. These kharif crops are being grown under rainfed condition and to some extent under irrigated condition in limited areas. The major rabi crops are wheat, Bengal gram (chickpea) and rabi jowar. The pre- rabi jowar is cultivated on residual soil moisture, however the wheat and Bengal gram are grown with supplemental irrigation where open well, borewells and small water reservoirs are available with the farmers. Earlier the farmers were applying irrigation water by surface/ flood method, but at present they are using pressurized irrigation methods because of which they are saving significant amount of irrigation water.

With regards to soil types, about 19.91 % of the total geographical area is deep black soil, 20.78 % is medium deep black soil, and 59.30 % is shallow black soil<sup>45</sup>. The scenarios of long-term normal rainfall distribution pattern are 623.5 mm from Southwest Monsoon, 83.5 mm from Northeast monsoon, 3.8 mm from Winter, and 23.3 mm from Summer with annual rainfall of 734.3 mm in 39 rainy days. With regards to irrigation resource structure available and the irrigated area by various structures, the maximum cultivated area is under open wells (59.6%) followed by canal (15.5%), and reservoir/ tanks 14.9%). Very limited area is irrigated through borewell, lift irrigation and farm pond. The cropping intensity is 120 % only.

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<sup>45</sup> <https://agricoop.nic.in/hi/agriculture> contingency

Table 52 Weekly Rainfall Pattern during Kharif 2021

Sr. no.	AURANGABAD			JALNA	
	Week with date	Rainfall received, mm	% Deviation over normal rainfall	Rainfall received, mm	% deviation over normal rainfall
1	2.6.2021	34.1	288	7.8	-15
2	9.6.2021	59.1	139	50.4	223
3	16.6.2021	12.5	-63	58.9	55
4	23.6.2021	15.8	-48	24	-24
5	30.6.2021	53.8	45	75.7	105
6	7.7.2021	0.6	-98	1.5	-96
7	14.7.2021	109.8	281	120.7	288
8	21.7.2021	36.6	9	72.2	93
9	28.7.2021	22.3	-45	51.9	17
10	4.8.2021	7.6	-78	0.8	-98
11	11.8.2021	5.5	-87	6.3	-86
12	18.8.2021	58.4	118	95.6	219
13	25.8.2021	82.2	131	62	63
14	1.9.2021	62.7	70	80	102
15	8.9.2021	149.9	285	146.8	277
16	15.9.2021	22.2	-32	65	-77
	22.9.2021	61.8	89	90.2	197
17	29.9.2021	205.6	433	144.5	339
18	6.10.2021	64.4	224	41.5	80
19	13.10.2021	18	2	25.3	25
20	20.10.2021	23.8	30.1	30.1	21.3
21	27.10.2021	0	-100	0	-100
22	3.11.2021	0	-100	0	-100

(A) Aurangabad district

On 27<sup>th</sup> October 2021, both experts of the PoCRA project along with state government officials (Agricultural assistant and Cluster assistant) working in the PoCRA project visited Gandheli and Adgaon Budruk villages which is 10-17 km away from Aurangabad city. The Gandheli and Adgaon Budruk gram panchayat falls

under the administrative control of Aurangabad Taluka. The village Gandheli a Gram Panchayat is located 10 km away from Aurangabad city. The total geographical area is 1451.03 ha. The total population of this village is 2996 and the total number of households in the village is 535. Most of the famers are engaged in agriculture activities. In another village Adgaon Bk, the total population as per 2011 population census is 3184 and total number of households are 593. About 792 cultivators in the village are engaged in their farm activities throughout the year and 621 are seasonal agricultural workers. The cultivated area is 1326.9 ha in which the famers are growing major kharif and rabi field crops, with very much limited area in horticultural fruit crops.

In Gandheli village, both experts discussed with the farmers in presence of Agriculture Assistant and cluster assistant to get the details about the benefits accrued by the farmers through the PoCRA project and any constraints faced while implementing the PoCRA projects. About 10-12 farmers, who were present in the meeting informed that the impact of this project is very good, and it may be extended further so that all needy and eligible farmers may also get benefitted through this project in subsequent years. They further requested that besides the crop farming, natural resources management activities, being operated, the dairy enterprises activities may be introduced to get extra benefits, if any natural calamities like long dry spell, or heavy rains damages their farm produce. With introduction of dairy farming, they may earn some extra income for their livelihood. In this village Grampanchayat, the following PoCRA components/ activities are being operated for the benefit of the farmers

- 1) Goat farming (number not known);
- 2) Farm pond :1
- 3) Shed net :9-10
- 4) Polyhouse 6-7
- 5) Shed net: 4 under progress
- 6) Horticulture 10-12 ha area (Guava, custard apple, Mosambi, Mango. Additional 6 ha area is in progress
- 7) Cement bandhara (C& B) :4
- 8) Nala excavation :2
- 9) Drip irrigation: 10 ha in cotton and vegetables crops.
- 10) Sprinkler sets: 5 ha

Cropping pattern being followed and yield improvement:

During kharif season, the famers are growing Cotton, soybean, red gram (sole crop as well as inter crop), kharif jowar and during rabi season, wheat, chick pea, pre-rabi jowar and vegetables. While discussing with farmers about the yield improvement of different crops in project area, the reported that the yield and quality of farm produces has improved substantially. As an example, in cotton crop, the yield under drip was 10-12 q/acre and in surface irrigation 7-8 q/acre. Similar trend was also seen in other field crops.

Water resources structures and utilization

In this area, the minor irrigation project, which has been constructed by State Agricultural department, recharge open well under normal rainfall year and the farmers grows kharif fodder crops / rabi fodder crops for feeding their milch animal. Considering the importance of the dairy enterprises, they made a proposal for introduction of animal husbandry through PoCRA project. Similarly, the Cement Bandhara structures, developed through PoCRA project has also helped the farmers to increase irrigation and cropping intensity substantially. In this gram Panchayat about 350 open wells are available and the command area of each open well is about 5 acres of land. They are irrigating cotton, red gram, soybean during kharif and chickpea, wheat and rabi jowar during rabi season. In cotton crop, the farmers are irrigating from October till December every year at interval of 3 days in light soil, 5 days interval in medium deep soil and at weekly

interval in deep black soil. However, they are not following the proper amount of irrigation water to be applied to different crops as per actual water requirement ( ETa ) of crops. As per the farmers version the kharif crop status was very good as the rainfall amount received was normal during most of the time in the week (refer table1),

#### Net shed unit, farm pond and open well

After discussion with farmers at Grampanayat office, we visited farm pond and net-shed unit area in one of the beneficiary farmers Mr Sandep Gambhirrao Deshmukh. The shed net unit having 32x64 m area was constructed through PoCRA project during the financial year 2020-21. When the expert visited to this site, the Capsicum crop was grown with stagger planting with an objective to harvest and bring the fruits throughout the year and earn more farm income during lean supply period. The crop was in flowering to fruiting stage and the farmer could not give the details of any financial benefits accrued due to shed net unit. In the nearby shed net unit, consultant / expert visited open well and the farm pond, which were financed through PoCRA project. The dimension of the farm pond was 30x30x3m, and fingerling (7000 in numbers) were dropped in the pond to rear fish also. Since this is first year, no information has been gathered on financial benefit accrued from this fish farming activities. The Financial support given to the farmer from PoCRA was Rs. 1.62 lakh and the remaining amount of Rs 2.30 lakh was spent by the farmer only. The secondary open well was also developed near the farm pond, which was being used for keeping the water level at optimum depth. The same open well water was frequently used for irrigation in shed net unit.

Then the same officials visited another village i.e., Adgaon and reviewed the work of the PoCRA project, with Shri Ram Bhimrao Hake, who has received benefits from several component of PoCRA activities. He has planted Guava, Mosambi, and Mango in 3.50 acres of land. The horticultural fruit crops are in establishment stage. He may receive the benefit after 4-5 years. Besides, he has also received the benefits of sprinkler, drip system with all accessories and deriving substantial benefit from kharif and rabi crops as he has explained to the visitors and reported in the following table. During this year, the rainfall was very good and water availability for rabi crop was substantial which might be exploited for rabi season crops.

The following Table shows the impact of PoCRA project on yield of kharif and rabi crops as the farmers adopted improved package of practices as per the guidance of the state agriculture department.

*Table 53 Change in Productivity of Main Crops Before and After*

Major kharif and rabi Crop	Before PoCRA project	After PoCRA project
Cotton	3-4 q/acre rainfed	6-7 q/acre in surface irrigation, 10-12 q/acre in drip
Red gram	3 q/acre rainfed	6-7 q/acre, with supplemental irrigation
Soybean	3 q/acre	8 q/acre, sprinkler irrigation used during long dry spell
Gram (Chickpea)	2-4 q/acre	6-8 q/acre with sprinkler irrigation
Wheat	6-7 q/acre	12-14 q/acre with sprinkler irrigation up to ear-head emergence stage, and flood irrigation thereafter if required.

### Marketing network:

They are selling all farm produce in Aurangabad market, If it is harvested in bulk quantity at once, then they are sending to Nasik, Jaipur and Delhi market through agent. The farmers of this village are approaching to state agriculture department to create FPO, for regulating market structures.

### Soil salinity / secondary salination.

This type of problem occurs in an area where huge amount of irrigation water is applied, and water logging condition is developed in irrigation command areas. The salinity problem occurs in semi-arid region of the country in irrigation command area. Since there are no such water resources structures created by the State Agriculture /Irrigation department, the salinity problem is almost negligible.

### B) JALNA DISTRICT (Date of visit: 28.10.2021)

Two villages: Tupewadi in Badnapur Taluka and Tapovan in Bhokardan Taluka.

Description of Villages: On 28<sup>th</sup> October 2021, both experts of the PoCRA project along with state government officials (Agriculture assistant and Cluster assistant) visited Tupewadi and Tapovan villages. The village Tupewadi and Tapovan falls under the administrative control of Badnapur and Bhokardan Taluka, respectively. The village Tapovan is located 22 km away from Jalna city. The total geographical area of Tapovan is 607 ha. The total population of this village is 1890 and the total number of households present was around 365. Most of the farmers are engaged in agriculture activities. In another Tupewadi village, the total population as per 2011 population census is 2977 and the total number of households are 599. About 952 cultivators are engaged in their farm activities throughout the year and 176 are seasonal agricultural workers.

Visit to Tapewadi village in Badnapur taluka: First we visited Tapewadi village in Badnapur taluka and discussed with 7-8 farmers on impact of the PoCRA project on their farm income. In this villages most of the beneficiaries are engaged in seed production of vegetable crops in shed net unit where more than 300 shed net units are available. One of the farmers, during last year earned Rs 1.5 lakh from 10 guntha shed net unit. In this villages about 300 shed net units are available and the turnover from this unit is about Rs 5.0 crore as narrated by the farmers of this villages. At District level, the Seed Companies are well established, and they are procuring the seed material from the farmers at higher rate and after further seed processing/ packing, they are distributing in different states as certified seeds and earning lot of money. Some of the seed companies in Jalna districts about which information could be collected are:

- 1) East-West Seed company, 2) Mahyco seed company, 3) Ananta Agro-Seeds, 4) Bhagya Laxmi seeds, 5) Talas Seeds, and 6) Seetal Seeds

The farmers of this village have also been benefitted from seasonal field crops and the detail trend of crop yield has been depicted in the following Table 45.

Table 54 Performance of PoCRA project on overall production of kharif and Rabi crop

Name of Crop	Before the Project	After the Project	Impact of Drip /sprinkler
<b>KHARIF SEASON</b>			
Cotton	4-5 q/acre	5-6 q/acre	12-18 q/acre under ratoon system
Tur (Red gram)	6 q/acre	8.0 q/acre	-
Soybean	3-4 q/acre	7-8 q/acre (BBF planting )	8-9 q/acre with sprinkler system
Moong and urd	3-4 q/acre		

Name of Crop	Before the Project	After the Project	Impact of Drip /sprinkler
Ground nut	1.5 q/acre	3 q/acre	They are using SB11 variety
<b>RABI SEASON</b>			
Wheat	4-5 q/acre under flood irrigation 4 times	8-9 q/acre	sprinkler irrigation three times up to ear head emergence stage + one flood irrigation thereafter
Chick pea	3-4 q/acre 3 irrigation by flood method	7-8 q/acre by sprinkler three times at before sowing, flowering and pod development	
Rabi Jowar	6-7 q/acre	15 q/acre 3-4 Sprinkler irrigation up to 4 ft crop height	Variety Maldandi -35.

The crop performance under best management practices with pressurized irrigation system in all kharif and rabi crops has outyielded significantly. The income generated from the extra crop yield have been used / invested by the farmers in further expansion of farm activities, returned the farm loan, for higher education of their children and for meeting social responsibilities.

List of components of PoCRA project implemented in this villages

The agriculture Assistant who is implementing various activities of the PoCRA project informed that the following activities are being carried out under his jurisdiction:

- (1) Individual Farm pond (30x30x3 m dimension) : 15
- (2) Lining of farm pond: 7
- (3) Drip irrigation: 75 beneficiaries
- (4) Sprinkler irrigation: 21 beneficiaries
- (5) Plantation of horticultural fruit crop (Guava, custard apple, lemon, Mosambi, Pomegranate): 35 beneficiaries
- (6) Fishery farming: 3 beneficiaries
- (7) Electric pump: 10 beneficiaries
- (8) Diesel pump: 2 beneficiaries

Due to development of water resources structures and implementation of pressurized irrigation system, the farmers are increasing their areas under cultivation by one and half times more area. One of the farmer Mr Ramesh Bhaskar Kafre, cultivated 10 acres of land during kharif season and 7 acres during rabi season with farm pond water and increased the cropping intensity by 170% . He had grown Cotton, Red gram, Ground nut, Soybean and Green gram during kharif season and Jowar, Chick pea, Onion (for seed production) and Wheat during rabi season. From this 10 acres of land he had earned gross income of about Rs 18.00 lakh with total expenditure of Rs 8.00 lakh. The same farmer has created shed net unit in 2 acres of land on its own and the farmer is generating substantial farm income every year from his available cultivated land. Since long he has been facing problems in selling vegetable and cereal crop in local market and suggested for creation of adequate market networking so that the farm produce is disposed at the earliest possible.

Visit to village Tapovan of Bhokardan Taluka: Then expert visited another village Tapovan of Bhokardan Taluka where the shed net unit is being used for floriculture ( Jarbera plant) through developed farm pond. Shri Vasantrao Ganpatrao Kadwane has developed shed net unit in an area of 36 mx56m (2016 sq m area) and providing irrigation, fertigation through drip system. Through PoCRA project, he has developed farm pond and providing irrigation water through underground pipeline. Near shed net unit he has made open well with solar operated pump of 3 Hp and filling this open well with farm pond water whenever it is

required. He himself has constructed another shed net unit. This year he has taken seed production programme of chilli. Through the seed production and selling at Jalna, he earned lot of money. From Jarbera, the farmer is earning net profit of Rs 5-6 lakh per year from the net shed unit of 2016 sq m area. The annual total expenditure was around Rs 10 to 11 lakh. The introduction of such enterprise has benefitted to the needy farmers substantially and it may be considered to be extended to other villages on large scale basis.

#### Outcome of project activities in three villages

The following PoCRA project activities has been completed / under process in three different villages where the agriculture assistant is operating/ monitoring and is providing all possible support to the farmers for their overall benefits.

- 1) Drip and Sprinkler: not furnished
- 2) Net shed unit: 130 completed and 25 under process
- 3) Farm Pond: 33
- 4) Fishery :12
- 5) FPO: 3

#### Overall suggestion

1. The development of more shed net unit is highly essential to increase farm income of the small farmers. Provision of Insurance of the shed net unit may be introduced in case it is damaged due to high wind speed or heavy rains.
2. More number of secondary water reservoir / farm pond may be constructed, and impact of the water reservoir may be made at frequent interval. Because the observation on ground water fluctuation from the observation wells / piezometer at frequent interval is highly essential to see any changes on ground water level in the developed water resources areas. The fluctuation with respect to rise in ground water table will be useful to quantify the volume of water recharged into the ground and increased the water availability to the field crops.
3. Use of plastic mulch in drip irrigation system may be advocated in different field crops in both the seasons as well in summer season to save significant amount of harvested rainwater.
4. In secondary reservoir, where integrated farming system is adopted, use of evaporation retardant or planting of wind break trees on the embankment of the water reservoir may be introduced as 18 % of the harvested water is evaporated into the atmosphere and enters into hydrologic cycle.
5. The farmers are not receiving good market price of the vegetable particularly tomato and onion during peak supply period. Hence matching grant for assets like solar dryer may be provided to farmers or should be made accessible through custom hiring centres (CHC) so that farmers can use them to increase the shelf life of their produce and to prepare value added products.
6. Assessment of crop moisture stress through remote sensing may be introduced and actual water demand may be planned to be computed in canal command area as well in small water shed area. Similarly, the intensity of pests and type of pests / diseases may be monitored through the available equipment under precision / smart agriculture project.

## 5.5 Field Observation by Environment

Sukta, Bhawanwadi, Padoli, Dukkarwadi and Yasawandi villages under Sukta panchayat in the Bhum subdivision of Osmanabad district were visited by Environment Expert Mr. Arindam Datta from 15 November to 17 November 2021.

The meeting with the VCRMC was conducted at the Sukta Gram Panchayat office in presence of the Panchayat Pradhan, Agriculture Assistant (Mr. Nishikant Godre) and Cluster Assistant-Bhum (Mr Vijay Rathod). The village is located at 18°31'40"N; 75°37'59"E.

The DPR for the NRM work for the entire group panchayat was prepared by a third-party Institute (respondents could not remember the name of the institute). However, most of the activities in the DPR was cancelled due to lack of technical details. Three CNB and one CCT have already been constructed in the group panchayat area. The CNB work has been completed in the Bhawanwadi village and the CCT in Dukkarwadi.



**CNB constructed in Bhawanwadi and Sukta village under PoCRA (photo with Agriculture Assistant, Cluster Assistant and VCRMC members)**

Kharif season crop in the village are Soyabean (main), Tur and Mung, while Jowar and onion are major crops in the Rabi season. 12-13 quintal of Soyabeans are produced per ha in the village. The market is around 25 Km (at Barshi) from the village. They sell soyabean at a price of about INR 5500/ Quintal . The nearby market for Onion is at Solapur which is about 150 km from the village. The maximum rate of onion at the market is 200/quintal. Thus, the farmer face huge loss due to long transportation. The village is having a local diary, where farmers sell the cow milk at INR 25/L and buffalo milk at INR 35/L. Most of the households have LPG connection, but the usage of LPG has reduced since the price hiked last year. Presently, at least half of the households in four villages are using traditional fuel for regular cooking.

There are about three thousand farmers in the village, out of which 2200 are registered under the PoCRA. Eight hundred of the registered farmers got benefitted from PoCRA. There is a problem in getting the benefit and subsidies from PoCRA. Some of the farmers got their eligible subsidy back from PoCRA after long time of investment and this led to discouragement among other farmers to participate in PoCRA activities to get benefits.

Also some people complained that because of delay in verification of assets by the agriculture assistant, processing of their eligible subsidized money is getting delayed. The village got PoCRA money for the NRM activities late. They told that one of the CNB has been constructed six months earlier, but they have not yet received the payment for the NRM work under PoCRA project. Due to this delay, other sanctioned NRM activities are also getting delayed in the area.

The agriculture assistant told that presently there is a delay in releasing the money from the PoCRA side. The VCRMC member also informed that, the VCRMC is supposed to get INR 25,000/- from the SDM office as a contingency grant after the formation of the VCRMC; however, they have not yet received the same. However, villagers are happy with the existing benefits from the PoCRA as it has visibly improved the agricultural productivity and water availability in the area.

There are about 2000ha of agricultural land in the four villages of the group panchayat. There is barren land in the village, VCRM is interested to undertake plantation activity in the barren land if there is support from the PoCRA. The village is having demand for motor and pipelines, to get the water to the cropland from the CNB and other available water structures. However, presently these are deactivated under the PoCRA.

The village is having an acute problem of wild animals (wild boar and deer) damaging the crops. Villagers looking for support to develop fencing around the cropland/village to protect the crop. The villagers and the VCRM members are requesting the PoCRA support to develop community farm pond in each village. The Panchayat assured to provide land for the community farm pond, but at present the activity has been discontinued under the PoCRA.



Dumping of construction related waste materials at the site of CNB at Dukkarwadi village, Crop residue burning at Sukta village.

During the visit and discussion with the VCRM, no women member was found to be present during the discussion. Villagers informed that women members are there in the VCRM, but they never take part in the VCRM meeting. However, it was noted that women were active in the agriculture fieldwork in all four villages.

About 90% of the crop residues (soyabean, tur and Mung) are burnt in the field remaining used as fodder. It was found that the people have no knowledge about safe disposal of plastic bottles of agrochemicals. The contractors of the NRM work have left used materials at the construction sites only due to difficult terrain. There is no regular soil testing or individual soil health card available in any one of the villages. Gram panchayat office has one soil data for the four villages, but present members have no idea from where the soil sample and when the soil sample was to be collected for the analysis.



Meeting with VCRM and Panchayat Pradhan at the Yasawandi village

The Yasawandi village is located at 18°34'9"N; 75°41'45"E. Agriculture Assistant Mr. VL Shinde and Cluster Assistant Mr Ganesh Shendge, VCRM members and Gram Panchayat Pradhan were present. No women VCRM members were present in the meeting. It was informed that women member of the VCRM normally do not participate in the VCRM meetings; however, the women members get involved in other VCRM activities.

Soyabean and tur are the major Kharif crops of the village, while wheat and Onion are the dominant rabi crops. The village also has horticulture crops like pomegranate, mosambi, mango, tamarind and banana.

The population of the village is around four hundred; however, there are 600 to 700 cattle are there in the village. The village produces about 1500L of milk daily. However, there is no market for the milk. Villagers themselves prepare 'khowa' from the milk and mostly sell in the local market. Villagers are looking for training and support to develop local community based dairy farm to get proper benefit of the milk produced in the village. Ninety percent of households of 125 households use LPG for cooking.

The village has four ponds, twenty-five borewells and 10 to 15 dug wells. However, most of these water storage structures get dried up in the summer and the village faces acute water crisis. There are two farm ponds; however, they get dried up as there is no lining. Villagers could not undertake lining of the farm pond, due to increase cost of the lining materials.

Jowar and wheat residues are used as fodder during the summer season, however, cattle graze in local barren lands during the monsoon and winter seasons. Cattle dung are used as compost in agriculture land along with soyabean and tur crop residues.



Dried community farm pond at the Yasawandi village



CCT work completed at the Yasawandi village

Among ninety farmers in the village, seventy farmers are registered under the PoCRA project. People have got support of Sprinkler and drip irrigation sets from PoCRA. Sixty-three applications of drip irrigation are still pending. People are looking for support related to pipes and motors as they need to borrow water from 3 to 5 km long distances. Fifty people had applied for motor and pipes, but it was never sanctioned by the PoCRA. VCRMC informed that the processing was delayed in the absence of timely support by the former CA and at present the scheme for motor and pipes have been discontinued under the PoCRA.

According to the DPR, 10-15% of the NRM work have been completed in the village. Among six CCT in the DPR, four have already been completed, three compartment bunding have also been completed. Beneficiaries of the village have got discouraged to take the PoCRA support due to delay in sanction and delay in the disbursement of the subsidy amount. Again, the cost of the materials has increased in the recent years, but the PoCRA support is fixed, this is also discouraging to the farmers to apply under PoCRA project.

There is no soil health card available with individual farmers in the village. Farmers of the village have not yet attended any FFS related to pesticide management. Few People have got FFS training for shadnet. There are four applications for shade net, all these are pending at 'Desk 4' for more than six months. One of the farmers (Baliram Ramling Sonnar) informed that his application for drip irrigation is pending at 'Desk 4' for last 4-5 months. There is a problem with ADHAAR linking to the DBT site. The CA informed that sometimes the ADHAAR linking to the bank account and DBT portal is creating problems in transferring the subsidy amount like it happened with Satish Narsu Sonne. In one case, the ADHAAR is linked to bank

account, but the CA is unable to link it with the DBT portal, and as a result the transfer of subsidy amount is getting delayed. This village is also having problems from wild animals, and they are looking for any kind of support for fencing around the agricultural land to protect crops from the wild animals.

The issue of crop residue burning and mishandling of pesticide bottles were not noticed in the village. However, it was noted that farmers are not using any safety gear while applying pesticide/chemicals to the field. During the meeting with the VCRMC, it was found that one women farmer in the nearby Anjansonda village have written a book on PoCRA activities in the Bhum sub-division.

### 5.6 Field Observation by GIS Expert

Sukta, Bhawanwadi, Padoli, Dukkarwadi and Yasawandi villages under Sukta panchayat in the Bhum subdivision of Osmanabad district were visited by GIS associate Shivani Sharma from 15 November to 17 November 2021. The landuse and land cover analysis of the region is presented in figure below.

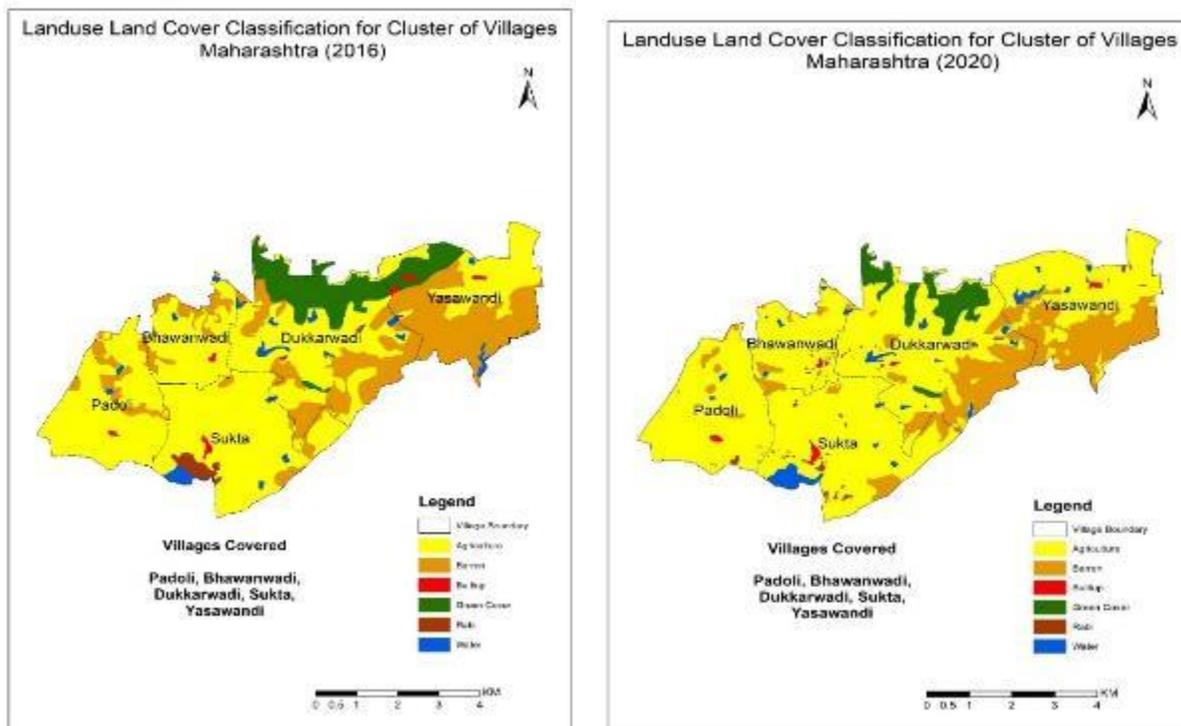


Table 55 Statistics of Cluster 7

Class_Name	2016	2020
Agriculture	29.26	34.74
Barren	11.43	8.22
Built up	0.27	0.22
Green cover	4.34	2.08
Rabi	0.47	0.37
Water	0.92	1.05

\*Area in sq. km

It is also observed that nearly 3.21 Sq km of barren land has been reclaimed under agriculture. There has been slight increase in both built up and surface water areas in above clusters.

## 5.7 Field observation by Sociologist

- Villages visited –
  - Jamburn, Dist Hingoli
    - Total households - 1904
      - 1770 households are from tribal communities, 20 from SC and the remaining from OBC
      - Agriculture and allied activities are the mainstay of economy and 80% of the farmers are small and marginal
  - Bhosi
    - Total household – 270
      - 70 are ST households, 2 are SC and the rest are from OBC and OC community
      - Agriculture and allied activities are the mainstay of the economy
  - Pimpaldari-Taraf-Nandapur
    - Total households – 550
      - 375 are ST households, 70 are SC and the rest are from OBC and Muslim households
      - Agriculture and allied activities are the mainstay of the economy Majority of farmers in this village are either small or marginal
  - Somvadi – POCRA 3<sup>rd</sup> phase village
    - Total households – 150
      - All households are from ST community
      - Agriculture and allied activities is the mainstay of the economy
      - Majority of farmers in this village are either small or marginal
- Method of data collection – FGDs/Key person interview
- Date of field visit – 30<sup>th</sup> November - 2<sup>nd</sup> December 2021
- Team – Vivek, Mini

### Performance of VCRMC

- VCRMC meetings were conducted mostly once in a month in all the visited villages. The main activities undertaken were - review of project progress in their village, guidance to farmer regarding application for matching grant, approval of the application, payment information and liaison with department for payments.
- The key documents maintained were records of meeting, visitor register and documents related to individual applications.
  - Agriculture assistant attended all meetings and maintained minutes.
- VCRMC in all the four village was recently formed, however was facilitating registration and application process through portal/mobile.
  - In Somvadi, the VCRMC was yet to open bank account.
- The main crops grown in all the study villages are cotton, soya bean, pigeon pea and toordal during kharif and chickpea, wheat and jowar during rabi. Rabi crops are primarily rainfed while kharif crops are irrigated through sprinklers.

- Other main crops grown are horticulture – mango, guava custard apple and sweet line and seasonal vegetables. Hence, majority of applications were support for micro-irrigation systems (drip/sprinkler) and horticulture plantations.
  - Majority of the farmers preferred to apply for micro-irrigation systems (drip and sprinkler) and around 25% of them have received pre sanction. Around 100 farmers applied for this support in the four villages.
    - Funds have already been disbursed to nearly 15 farmers in each of the four villages.
  - In Jamburan and Pimpaldari, farmers expressed that some of them have already got sprinkler sets as part of another Tribal welfare scheme where 100% grant was provided. So they expected POCRA also to give 100% subsidy and provide micro-irrigation to all the remaining tribal/ST households in the village.
    - They are of the opinion that any government schemes which do not offer at least 80% of subsidy for ST/tribal communities are not even worth considering.
- No major conflicts were reported amongst VCRMC members. Transparency was maintained and all activities/developments (pre sanction, sanction, training etc.) were communicated to the beneficiary.
- In village Bhosi, it was reported that only 4 to 5 members in VCRMC actively participated in meetings, while others were meek spectators and did not voice any opinion.

#### **Inclusion of vulnerable groups (SC/ST/Women/marginal and small farmers)**

- In all the four villages the composition of VCRMC was representative in nature with the mandated representations from SC/ST/marginal farmers, women farmers (4-5) and women SHG member.
  - But the SHGs were not formed as part of POCRA.
- Generally active participation of VCRMC women members in all the villages was reported to be low. They expressed that they are usually busy with household chores and other responsibilities and did not find it important to attend meetings. Even when they attended meetings, they did not voice their opinion or follow up on the application status.
  - Many a times households lived in small settlements near their farm and women worked as labourers. So they do not get enough time to attend meetings and also they feel attending such meetings is waste of time.
  - In Pimpaldari, sarpanch and upsarpanch positions were held by women, they attended all meetings, but were not actively involved in any decision-making processes. Male members of the family accompanied them to all the meetings and even did all the paperwork for them.
  - An exception is village Bhosi where some women managed to participate.
- Participation of women in FFS was also reported to be low either due to their engagement in many other household and farm activities or due to ignorance of projects activities and benefits.
- All beneficiaries, especially the small and marginal farmers who had received disbursement for micro-irrigation (drip/sprinkler/pipes/pumps) expressed that they have benefited from these assets. These technologies have led to water conservation and also saved their crops during less water availability in any season.
  - However, farmers who already had assured source of water supply (well/bore well) benefitted the most from these assets.
  - In all the four villages, less than 5% of women had land in their names and they did not avail any benefits of the scheme.
- Unfortunately, women sarpanch in village Jamburan served as a token leader (proxy representation) and exhibited lack of knowledge regarding VCRMC working and was unaware of the project objectives and goals. Most of the decisions were taken by her husband who is regarded as functional sarpanch.

### Performance of Krishi Tai

- In Jamburan, Krishi Tai has been appointed for nearly two years, but has been remunerated for only 3 months. She has undergone training by an NGO for aspects related to community mobilisation, account maintenance, agricultural practices and FFS. She has been actively involved in imparting knowledge of the project especially to small and marginal farmers to avail benefits. She opined that lack of remuneration is making her less motivated and expressed her displeasure to continue work.
- In Bhosi, Krishi Tai has been actively engaged in raising awareness about the project and application procedures through home visits for two years but has received only Rs 1500 till date. She mentioned that she will stop discharging her duties if remuneration is not given on time.
- Krishi Tai has been appointed in Pimpaldari in May this year, but yet to receive any training. Also she is not aware of any of her role and responsibilities and has not undertaken any activity.
- In Somvadi, Krishi Tai is represented by her husband, and she is totally unaware of her roles and responsibilities.

### Project supported women SHGs

- There is no project supported women SHGs in any of the villages visited.
  - However, women SHG members are also members in VCRMC as part of the mandate
  - In Somvadi, SHG (not supported by POCRA) was undertaking goat rearing as livelihood activity.
- There is no project supported FPC in any of the villages visited.

### Main benefits reported

- Farmers in all the four villages mentioned that beneficiaries of irrigation systems development activities like sprinkler reported an increase in their farm yields.
- In Pimpaldari, farmers opined that the project has helped farmers to better understand technologies related to preparation and cultivation such as using improved seed varieties, land preparation and rational use of fertilizers.
  - In Pimpaldari and Somvadi, one FFS was conducted on package of practice for turmeric and soya bean. This activity was contracted to Bharat Agri, which is a farming technology platform with a mission of bridging the gap between technology and agriculture.

### Overall challenges identified by beneficiaries

- In Jamburan and Somvadi, community reported that landless migrated to other villages as daily wage agricultural labourers for nearly 6 months in a year (from Deepavali to Holli). Some have migrated to Pune and Aurangabad in search of productive employment.
  - Their main grievance is that POCRA is not inclusive and there are no specific programs like goat rearing or any other income generating activity exclusively for the landless.
- In Jamburan, Pimpaldari and Somvadi the panchayat was formed four months back and since VCRMC acts as subcommittee of the gram panchayat, the new batch was yet to receive any training on role and responsibilities of VCRMC. The members could vaguely recall the main activities undertaken by VCRMC. Only activity undertaken promptly is processing applications and following it up with the beneficiaries.
- Common demand from landless in all the villages is support for allied activities such as poultry, goat rearing and dairy and these activities was stopped abruptly from January 2020. Hingoli district is known for fine breed of goat rearing, and landless are keen to take up this activity.
- In Bhosi village, the newly formed VCRMC was yet to receive any training. They stated that the previous VCRMC members were taken to Ralegan Siddi as part of exposure visit, and they also did not pass on any important learning/lessons/experiences to the newly formed VCRMC members.

- The project requires that framers can get reimbursement only after the completion of activity and submission of bills. However, an important concern raised by them is the lack of resources (cash in hand) to invest upfront in micro-irrigation systems since they would already be constrained due to other expenses like land preparation, buying of saplings and labour costs among others.
  - Common concern is that they are not able to mobilise institutional credit for upfront payment and they are not keen to take any credit from local money lenders. Most of the farmers also did not have any savings/cash in hand to avail this benefit.
  - Another problem encountered by farmers is that when they buy micro-irrigation systems from shopkeepers, they get a bill which is inclusive of GST. However, the farmers lamented that they cannot claim the GST amount from the scheme.
  - Farmers lamented that it takes nearly 4 months for disbursement of funds creating an uncertain situation – their request is to reduce the procedures and the time taken from application to disbursement.
  - Access to institutional finance to avail project benefits remains low.
  - In village Bhosi, it was reported that in case of some farmers Aadar is still not linked to bank and hence they experience difficulty in availing benefits.
- Another important constraint flagged by farmers in Pimpaldari is the requirement of reliable source of water to install micro-irrigation systems. Wells available in the village are limited and do not provide sufficient water to raise Rabi crops effectively. Hence, farmers who did not have access demanded support for open dug well.
- Farmers expressed desire to avail benefits of polyhouse and shade net, but expressed that it required a much higher amount of investment and it becomes difficult for them to take it up at individual level. Agriculture assistant also said that the response of polyhouse and shade net in villages dominated by tribal population has been poor.
- Most farmers preferred to avail benefits of horticulture crops as it assured good income over a period of time. But, they encountered a peculiar challenge since drip is compulsorily given with horticulture crops and it becomes difficult for farmers to arrange upfront costs. They opined that they can install drip after they earn some profit through horticulture plantation. Hence they requested bifurcation of the requirement of drip from horticulture activities.
- Mechanisation component has been stopped for more than a year and farmers appealed that it has to be resumed at the earliest.
  - There is a huge demand for tractors, bullock mounted tillers, plough, individual sprayers and field implements.
  - Farmers reported that they rent tractors and during the harvest season, the cost of renting becomes high.
- Another important aspect reflected in meetings with the farmers and the larger village community in all the study villages is that they expected 100% grant or subsidy from all the government programs including POCRA. There is a reluctance to make any upfront payment and they continue to look for freebies.
- On-line training provided to Krishi Tai and others were reported to be non-effective due to challenges of having a smart phones and connectivity issues.
- A pertinent issue raised by ST/tribal farmers is that if they have availed any benefits from other schemes meant for ST/tribal welfare they are not allowed to participate in POCRA benefits.
- Agriculture assistant in village Jamburan mentioned that the area of the village is hilly and undulating and it will be a technical challenge to implement micro irrigation schemes.
  - Same problem was identified in Pimpaldri and farmers demanded that some solution has to be provided to undertake micro irrigation and save their crops.

- One of the respondents in village Jamburan also mentioned that during microplanning stage in 2018, many false promises were made regarding upfront payment to avail benefits of the scheme.
- In Pimpaldari, there are no women beneficiaries of this scheme and also they did not see any merit in women becoming the beneficiary since all major decision at home and in community are taken by men.
- In Pimpaldari, although VCRMC meetings are held regularly, there is a delay in the preparation of DPR for the identified activities.

### **Suggestions given by beneficiaries**

- Since VCRMCs members keep changing (depends on change in panchayat) frequent training/follow up refresher trainings on project guidelines and climate resilient agriculture practices has to be prioritised.
  - Old VCRMC members have to extend hand holding support to newly formed VCRMC and share their experience/lessons/challenges.
- Women sarpanch who exhibit token representation needs more motivation and hand holding to discharge their duties.
- Krishi Tai has to be remunerated on time and need more awareness and training on climate resilient agricultural practise
- Support is sought for nala deepening and widening, cement nala bunds, digging of farm ponds.
- Awareness generation about the POCRA project has to be intensified since many development programs/projects are running simultaneously and people tend to get confused.
- Solar fencing/wire fencing to protect from wild animals (wild monkeys/pigs/Neel ghai/wild boar).
- Provision of cattle shed has to be considered under this project. This will create employment opportunities for women.
- Support has to be provided for protective irrigation through community farm ponds along with lining
- Support and training sought for cultivation of fodder crops and improving livestock feed
- The most popular type of pipe used in irrigation is the PVC pipe and farmers demanded subsidy for PVC pipes under the scheme.

## **6. Compliance to Environment and Social Management Framework**

### **Objectives of the Midterm ESMF audit**

The purpose of this audit is to ensure that execution of the PoCRA considers potential environmental and social impacts that would most likely be affecting the desired results intended during the implementation of the project. The objective of the Environmental and Social Management Framework (ESMF) Audit is to audit and understand the measures that should be taken to mitigate the adverse environmental and social impacts while implementing the project. It is to use a holistic view of risk mitigation assisting in achieving the overall goals and objectives of the project.

The Mid Term ESMF Audit aimed at understanding many a fact which was instrumental in achieving desired or required level of ESMF implementation in the PoCRA project. The audit further looked into areas of concern that reduced effectiveness of ESMF benefits in the project implementation. The midterm evaluation of the ESMF was conducted for identifying appropriate actions to (a) address particular issues or problems in implementation and management; (b) reinforce initiatives that demonstrate the environmental and social effectiveness of the project towards the completion.

Environmental screening and guideline for environmental management were evaluated for each of the project activities, while the Environmental management plan was evaluated based on, i) Solid waste management, ii) Water pollution, iii) Impact on biodiversity and iv) Health and safety.

The social audit aims to understand the implementation and outcomes of the various measures that have been taken to mitigate negative social impacts like inequalities and disparities in various stages of the project cycle while emphasising that the projects overall goals and objectives aid in building resilience of smallholder farming systems.

Detailed information on the environment audit framework and social audit framework respectively is given in below sections.

### Approach

The ESMF framework proposed by PoCRA included the following steps to be considered at the cluster level based on the time steps defined:

1. Review of the Baseline documents for ESMF that have been prepared. Providing suggestions for modifications if any for collation of cluster level disaggregated data and information
2. Review and revisit of the environmental and social impacts based on the various components identified for implementation in the PoCRA and contextualising to the unit of analysis
3. Development of criteria for screening of interventions and categorisation as high, mid and low risk for all clusters selected
4. Identification of mitigation measures for adverse impacts at the cluster level
5. Checking the compliance of the ESMF with applicable legislation, policies and regulation of the government at the central and state level
6. Identify roles and responsibilities including reporting procedures
7. Highlighting need for technical assistance if any and
8. Outlining capacity needs

Following the steps 1 till 4, the baseline document for ESMF (two volumes of EMF and one volume of SMF including Tribal People's Planning Framework)) were thoroughly studied for understanding the scope of work under the audit. Step 5 clearly state the objective of the ESMF audit which is to systematically examine the compliance to legislation of measures that are adopted to mitigate the adverse environmental and social impacts which are anticipated while implementing various activities of the project. Details of project outputs and outcomes are summarised which will form the base for the audit. Proposed measures are assessed at the unit at which analysis is undertaken. For meeting the audit objective, list of project component wise indicators under both EMF and SMF are prepared for which the compliance with guidelines has to be checked. For data/ information on the listed indicators, in addition to which is already available through the baseline reports or other secondary source such project MIS, primary data requirement for collection at the field level was assessed. For each indicator, key respondent (identified among key project stakeholders including beneficiaries) was identified for whom a set of compliance related questions is designed. These set of ESMF related questions was part of MTR tools which was administered during MTR survey. The key respondents for audit were interviewed in the select project clusters. Based on the analysis of audit findings, exercise listed in step 6 till 8 can be undertaken to identify areas for improvement.

### Methodology

A mid-term environment audit survey was conducted in 2021 in the Eight districts – a) Aurangabad, b) Beed, c) Hingoli, d) Jalna, e) Osmanabad, f) Latur, g) Nanded and h) Parbani. 2628 villages were included under the PoCRA in the study area. A questionnaire-based survey was undertaken among the beneficiaries, VCRMC, project staff, Sub-divisional agriculture officer and PoCRA-PMU to complete the MTR environmental audit of the project implementation. The data available in the DBT portal for different activities implemented under the project was collected for quantitative analysis of the project objectives.

Following five tools were administered in project clusters;

- Household survey tool was administered in 241 project clusters covering 2410 households
- Focus Group Discussion (FGD) with beneficiaries was conducted in 16 project villages
- FGD with Village Climate Resilience Management Committee (VCRMC) was conducted in 16 project villages
- In-Depth Interview (IDI) with Farmer Producer Company (Director) was conducted in 24 project villages

- IDI with Self Help Group (President) was conducted in 24 project villages

The set of ESMF related questions was segregated based on key respondent category and was included in ESMF section in each of the above listed tools. One separate checklist of ESMF questions for key project staff accountable for following the guidelines especially cluster assistant, agriculture supervisor, agriculture assistant, and FFS facilitator was prepared and administered in the villages under qualitative sample. It should be noted that in household survey tool, section on ESMF was administered only on beneficiary who has accessed benefit under PoCRA.

### Areas of Enquiry based on ESMF Framework

#### Environment Management Framework (EMF)

The International Chambers of Commerce defines environmental audit as, A management tool comprising a systematic, documented, periodic and objective evaluation of how well environmental organization, management and equipment are performing with the aim of helping to safeguard the environment by (i) facilitating management control of environmental practices; (ii) assessing compliance with project policies, which would include meeting regulatory requirements

The key environmental issues that are having implications for the project are (1) high climate vulnerability of some of the project districts (2) Variability of rainfall in pre-monsoon and post-monsoon period. (3) Decreasing trend in rainfall in monsoon months in project districts; High evaporation / evapotranspiration in some of the project districts. (4) Soil of most of the project districts have low nitrogen and phosphorous (5) Land not suitable for cultivation (non-agricultural use and barren and uncultivable land) is gradually increasing; (6) predominantly land holdings are small or marginal. 78.98 percent farmers holding less than or equal to 2 ha in the project area (7) deficient water availability with overexploited ground water in some of the project talukas whereas less utilization of irrigation potential, (8) increasing use of chemical fertilizers and pesticides for higher production / productivity etc.

The project has three main components,

- (1) Promoting climate resilient agriculture systems
- (2) Climate smart post-harvest management and value chain promotion, and
- (3) Institutional development, knowledge, and policies for climate-resilient agriculture.

Considering that the project's environmental impacts would be mostly positive, and that the limited negative impacts were expected to be mitigated with suitable measures, the project was classified as category B as per the World Bank's Operational Policy on Environmental Assessment (OP 4.01). An Environmental Management Framework (EMF) was prepared for the project following the requirements of the category B project (according to OP 4.01 requirements) in order to describe the procedures and institutional arrangements for managing the potential environmental impacts from the project activities. The EMF was prepared in line with the legal and regulatory framework of the Government of Maharashtra and operational policies of the World Bank on environmental safeguards including Pest Management (OP 4.09).

The Environmental Audit is important to identify the environmental strengths and weakness of a project activity after implementation in field. This also can support to identify any gap or deviation from the original project management plan and helps to follow benchmark progress to safeguard the environment.

This environmental audit framework (EAF) has been developed based on the outlined objectives in the Environmental Management Framework (EMF) document of the PoCRA project which had used a participatory and consultative approach to prepare the EAF. The EMF identifies the responsibilities of project stakeholders, procedures for environmental and social safeguards screening and enhancing institutional capacity.

The EMF seeks:

- to facilitate compliance with the legal and regulatory framework,
- to establish procedures for environmental screening of the project activities,

- to describe the environmental management guidelines and plans for mitigation of potential environmental impacts of the project activities,
- to describe the institutional arrangements for environmental management of the project

The components of the EMF therefore include:

- a) Environmental screening: Checking the project activities is permissible and meeting the existing policies of the Government of India or Government of Maharashtra and World Bank's safe guard policies, checking legal and regulatory compliance.
- b) The EMF will also check the implementation of the Integrated Pest and Nutrient Management plan (IPNMP) as described in the EMF document of the PoCRA.
- c) Screening of Environmental Management guideline: Checking the project activities following the environmental management guideline as described in the EMF document of PoCRA. EMP outlining the responsibilities for implementation of the mitigation measures will be targeted as part of the audit.
- d) Screening of Progress in the Capacity Building Plan: a capacity building plan through training and IEC (information, education, communication) for various stakeholders is included in the EMF. The progress and success of the capacity building under the PoCRA project will be evaluated.
- e) Screening of Institutional management of the Environmental Management Plan of the PoCRA EMF.

### Social Management Framework (SMF)

Social audit is the process by which people, the final beneficiaries of the scheme, program, policies and laws are empowered to benefit and also to review the schemes. Social audit is also an ongoing process by which the potential beneficiaries and other stakeholders of the project and schemes are involved from the planning to the monitoring and evaluation of that activity or project. This concept has amply been used in social sector which brings on board perceptions and knowledge of people and the primary emphasis is on the outcomes and not merely outputs.

In the PoCRA project, the Social Management Framework has been prepared taking into account the exclusion and vulnerabilities faced by tribal people, indigenous people, landless and women households. It aims to reduce the distress such as higher production cost, low or stagnant farm productivity, lack of market access, degrading land resources and impacts of climate change among the vulnerable population. The project envisages extensive capacity development of the small farmers as well as the project functionaries. There is exclusive strategic focus for greater inclusion and proportionate representation of tribal in non-scheduled areas and their active association in project interventions in tribal dominated areas. The project also supports greater participation of women with a special focus on women specific issues across different project components that would help women for a better participation and decision making along with benefitting from the project interventions. For long term sustainability and inclusion of marginal groups' emphasis has been on the participation and involvement of the community institutions for not only identification beneficiaries but also their involvement in the planning, implementation, and monitoring of the project activities. The basic objective of the SMF is to check if the small, marginal, women and tribal were able to overcome the following key issues and challenges (as indicated in SMF – pg 77 to 84) after the implementation of the project.

*Assessment of following challenges listed in SMF for Small and Marginalized Farmers:*

- Equal accessibility to farm machinery: To check if there is ease of access to Custom hiring centers for small and marginalized farmer.
- Demonstration of climate resilient farming: To check if SF/MF farmers are provided with necessary resources to adopt and replicate the learnings taught to them in such demonstrations and FFS.
- Protected Cultivation: To check accessibility of small and marginal farmers to assets like shed net house, poly house, poly tunnels.
- Adoption of Integrated farming system (IFS): To check the participation of small and marginal farmers in adoption of the IFS and other integrated practices like Integrated Nutrient Management (INM) / Integrated Pest Management (IPM).

- Adoption of water efficient instruments: To check accessibility of small and marginal farmers to micro irrigation systems.
- Farmer Producer Companies: To check membership of SF/MF in FPOs and their participation in project agribusiness activities related to agro processing and value addition.

*Assessment of following challenges listed in SMF for Women and Tribal Farmers:*

- Inclusion and Participation of women and tribal farmers in the institutions formed under the project: Check participation of women and tribal farmers in decision making process.
- Engagement of women and tribal farmers in the FPCs: To check scope of participation of women in formal institutions like FPCs.
- Women friendly farm machinery: To check access to women friendly farm machinery.
- Protective Farming: To check if women and tribal farmers are provided with necessary resources to adopt protective farming.
- Promotion of micro irrigation system: To check accessibility of women and tribal farmers to micro irrigation systems.

*Social audit would refer to the baseline and midterm data and will specifically focus on the following issues:*

- Inclusion and *participation of MF/SF/marginalised social groups* (representation of all castes) – this aspect is captured through –
  - Project implementation documents of PMU and discussion with key project staff
  - VCRMC records/documents and discussions to gauge selection of beneficiaries for individual benefit activities, participation and decision making of MF/SF/ marginalised social groups, social audit activities undertaken by VCRMC
  - Inclusion of MF/SF/marginalised social groups at cluster level planning and demonstration of climate resilient agricultural systems and access to matching grants for water harvesting structures/micro-irrigation will be captured through discussion with SDAO/VCRMC/KVK/PMU
- Need assessment and tailor made training and capacity building exercises or *Gender concerns*– this is gauged through
  - Inclusion and participation of women in VCRMC, training/capacity building activities conducted for women, participation of women in FFS, FPC, FIG, cluster level planning, gender action plan documents of PMU, inclusion of women across social groups in SHG, access to matching grant support/credit accessibility
  - Access to farm machinery and introduction of women friendly farm machinery
- Inclusion of *tribal people* – this is captured through –
  - greater representation and participation in VCRMC, implementation plan of Tribal peoples' framework by PMU, on farm guidance to tribal, training/capacity building activities conducted for tribal, participation of women in FFS, FPC, FIG, demonstration of climate resilient agricultural systems and access to matching grants/credit accessibility for water harvesting structures/micro-irrigation, access to farm machinery
- *Citizen grievance redressal system* – this is captured through assessing –
  - The grievance redressal framework at village, cluster, SDAO, SAO and PMU level.
  - The number of grievances received tribal in particular, number of grievances addressed, time consumed for decision making
- *Transparency and accountability* - this is captured through -
  - Record keeping of VCRMC, accessibility of the documents by the community, details of the works with cost maintained by the website of the project, communication of physical and financial achievements under the cluster development plan

## ESMF Audit findings

### Assessment of progress of project under different activities

The project has three components namely (A) Promoting Climate Resilient Agriculture Systems (B) Climate Smart Post-Harvest Management and Value Chain Promotion and (C) Institutional Development, Knowledge and Policies for a Climate resilient agriculture. Under component A, there are three sub component i.e. A.1: Participatory development of mini watershed plans A.2: On-farm climate-resilient technologies and farming systems and A.3: Climate-resilient development of catchment areas. Under Component B, there are three sub components i.e. B.1: Promoting Farmer Producer Companies B.2: Strengthening emerging value-chains for climate-resilient commodities and B.3: Improving the performance of the supply chain for climate-resilient seeds. Component C, consist of three sub components i.e. C.1: Sustainability and institutional capacity development C.2: Maharashtra Climate Innovation Center and C.3: Knowledge and policies

Different natural resource management activities following the village mini water shade micro action plan developed by the VCRMCs were undertaken in different project villages.

### Climate Smart Agriculture and Resilient Farming Systems

Demonstration of climate smart agronomic practices were undertaken through participatory farmers' field schools (FFS) in different districts (Figure 30). Different climate resilient agronomic activities were included in the FFS. This includes, Contour cultivation, Broad bed furrow cultivation, Farrow opening, Protective irrigation using farm pond, Mulching, conservation tillage, incorporation of biomass, integrated farming system, integrated nutrient management, integrated pest management, intercropping, seed treatment, canopy management etc.

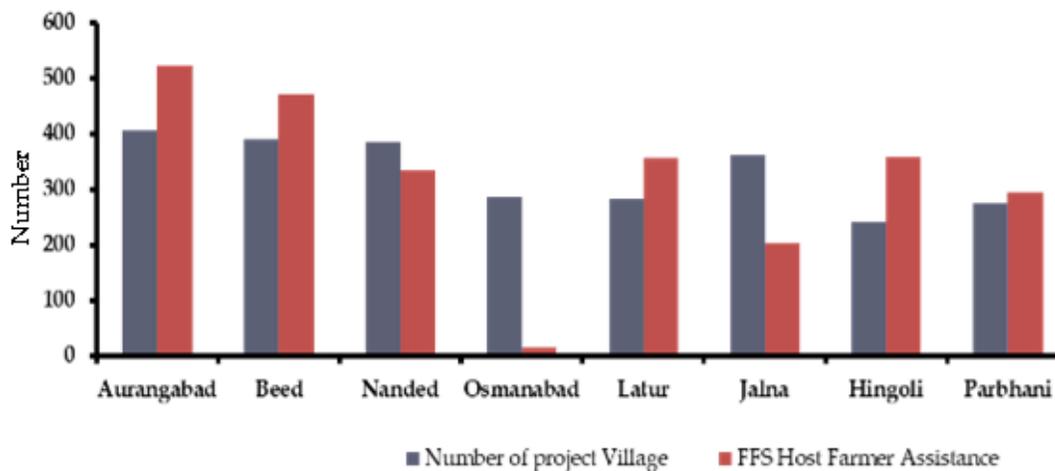


Figure 30 Assessment of FFS organized in different districts

Study suggests that in five district (Aurangabad, Beed, Latur, Hingoli, and Parbhani) there is possibility that at least one FFS was organized in each of the project village (Figure 30); however, least numbers of FFS was organized in the Osmanabad district (14) and there was comparatively lesser number of FFS in Jalna (202) district too.

Agroforestry and plantation are important activities for Enhancing Carbon sequestration and GHG accounting. Farmers adopted to agroforestry is more in Aurangabad (76), while Farmers adopting horticulture crops are more in Jalna (5527) (Figure 31).

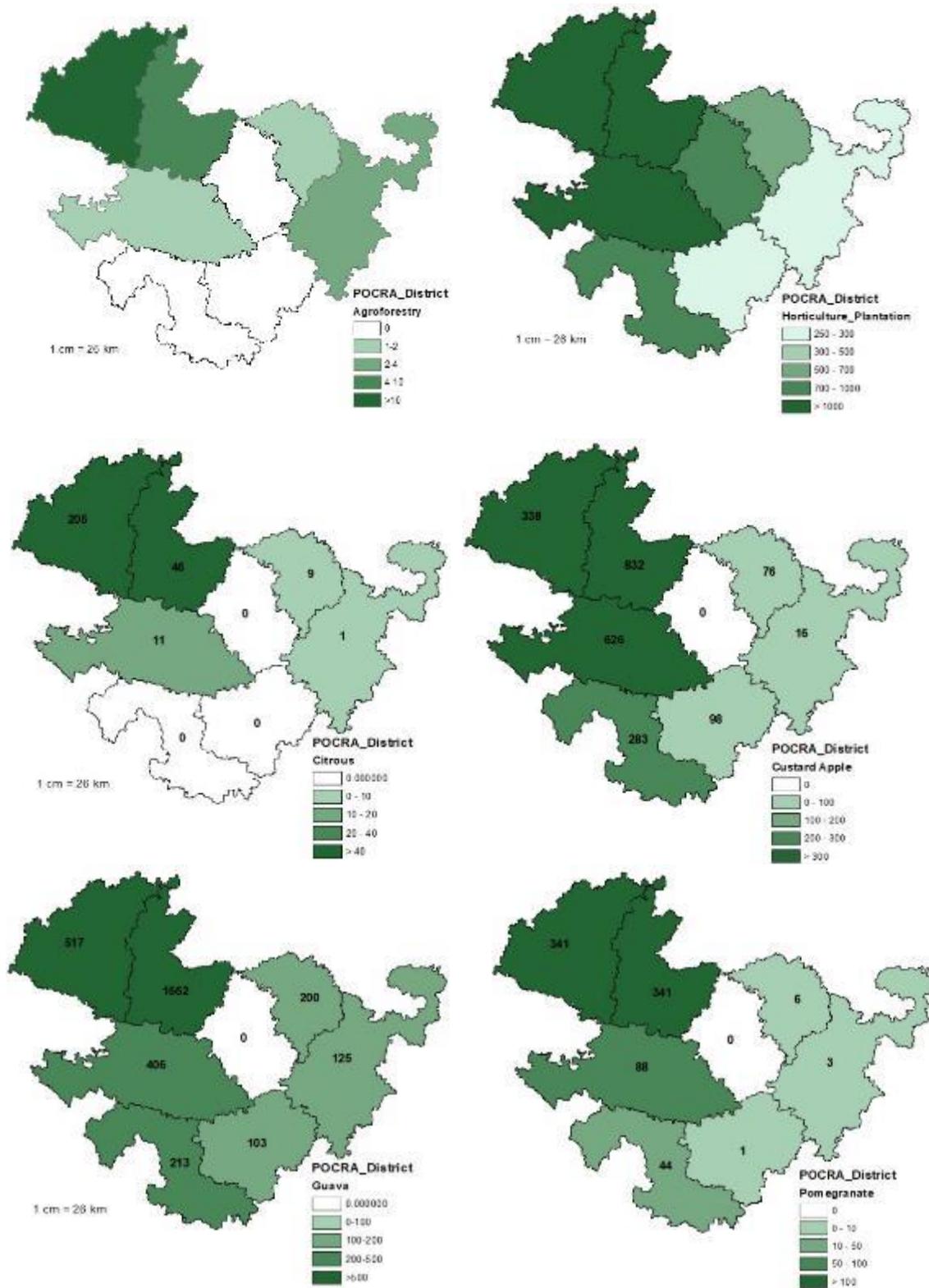


Figure 33 Adoption of agroforestry and horticulture in different districts

Figure 4 suggests that most of the fruit crop adaptation activities are centered in Aurangabad and Jalna districts, whereas there was no farmers adopted to fruit crop or agroforestry (Figure 31) cultivation in the Parbhani district.

Climate resilient agronomic structures were also adopted by the farmers in the study area. 1862 shadenets have already been installed in the study area. Among different districts highest number of shadenets (1072) are installed in Jalna (Figure 33). Installation of shadenet are higher towards the western side of the study area compared to the eastern side. 18 Polytunels are installed in Osmanabad district.

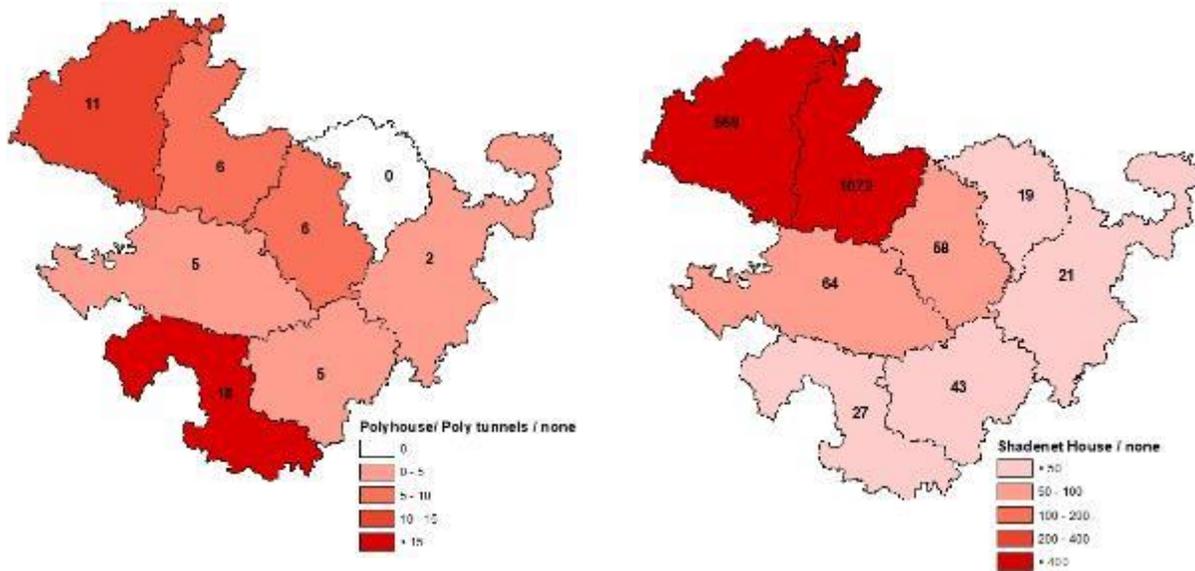
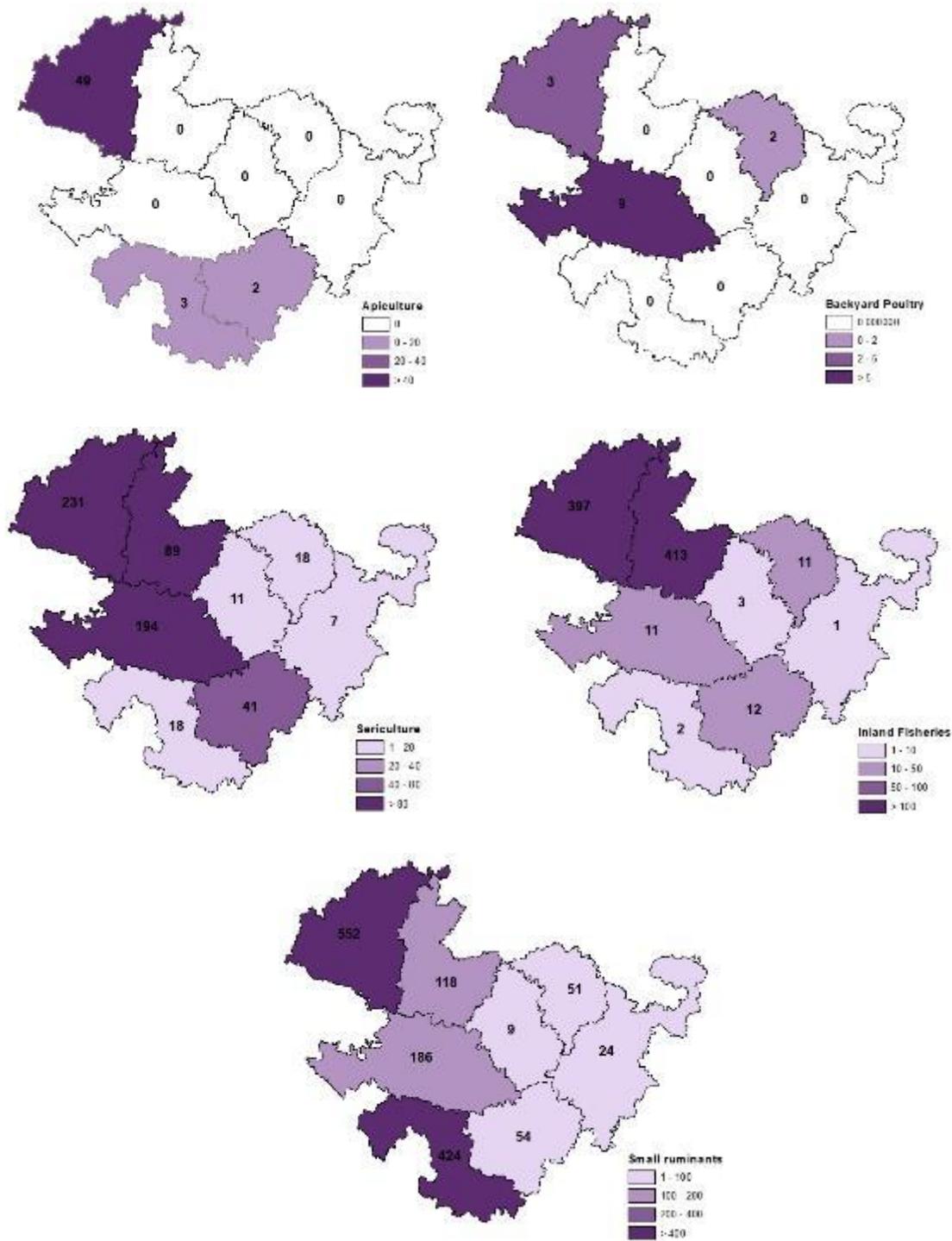


Figure 34 Spatial distribution of polytunnel and shadenet installed under the project

155 beneficiaries have taken the benefits of planting material for the shadenets. These were mainly used in already active shadenets. This indicates that shadenet activities were higher before the project in Aurangabad district compared to others, as the adoption of shadenet planting materials are higher in the district.

Among different integrated farming activities promoted under climate resilient agriculture system, the adoption of small ruminant rearing is more in the study area. About 1418 beneficiaries have adopted small ruminant rearing under the project. Among different integrated farming activities, adoption of backyard poultry is significantly low (14). The adaptation of different integrated farming system is more towards the western side of the study area, mainly in Aurangabad, Jalna districts (Figure 6). Adoption of integrated farming activities in the study area followed the order, Aurangabad (1232) > Jalna ( 620) > Osmanabad (447) > Beed (400) > latur (109) > Hingoli (82) > Nanded (32) > Parbhani (23).



### Promoting Efficient and Sustainable Use of Water for Agriculture

New water harvesting system was promoted in the PoCRA to improve the sustainable use of water. Rejuvenation of existing water structures was also facilitated in the project villages at individual and

community level. 2582 community farm ponds and 2041 individual farm ponds were developed in the study districts. The highest number of farm ponds are towards the western side of the study area. Highest number of community farm ponds were developed in Jalna (1528), whereas highest number of individual farm ponds were developed in Aurangabad (1427). (Figure 34).

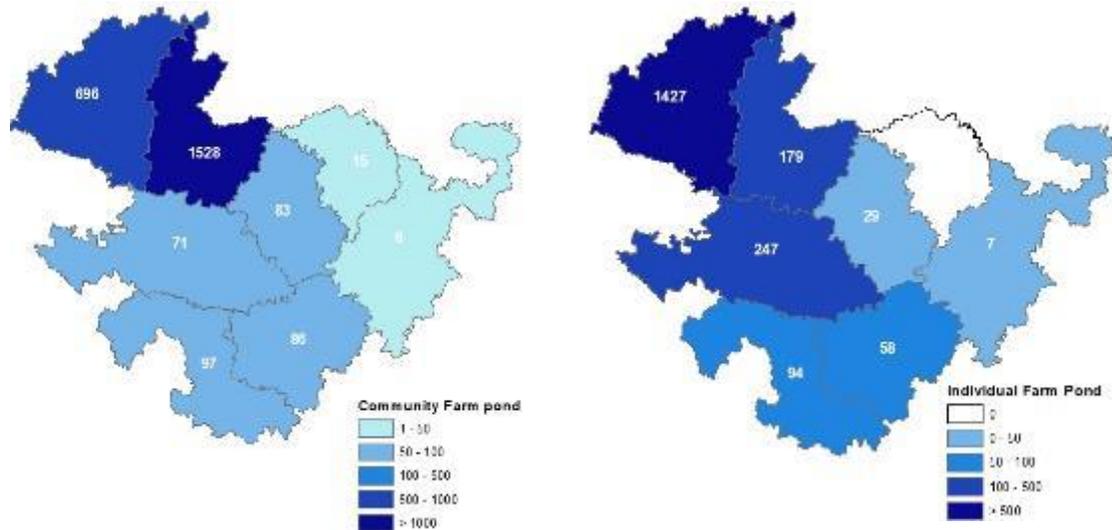


Figure 35: Spatial distribution of community farm ponds and individual farm ponds in project districts

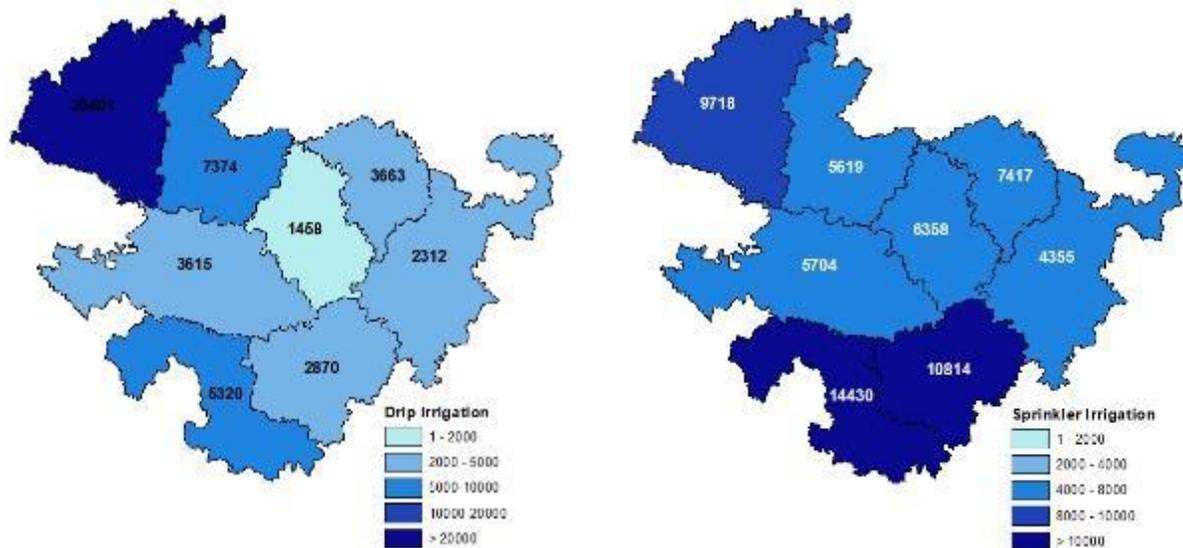


Figure 36 Spatial distribution of drip irrigation and sprinkler irrigation system adopted by the beneficiary farmers

Micro irrigation system is the major activity that was adopted by the beneficiaries in different districts of the area. More than 57000 drip irrigation system and more than 64000 sprinkler irrigation systems have been adopted by the beneficiaries in the project districts. Highest number of drip irrigation system was installed in Aurangabad (Figure 35). On the otherside, sprinkler irrigation systems are largely adopted by the beneficiaries in Osmanabad and Latur districts.

The PoCRA project has also facilitated the rejuvenation of existing water harvesting structures in the project villages. Well construction and recharge of open dug well activity has been promoted largely, and other

water extraction methods such as bore well and mechanical extractions were not permitted as per the guideline document. Thirty well recharging activities and nearly two thousand farm pond lining materials were undertaken by the beneficiary farms in the project area. Both the activities were higher in the Aurangabad district (28 and 993 respectively) compared to others. In addition, 97 new wells were developed in the project area, most of which are in Hingoli (21) and Osmanabad (26) districts (Figure 36).

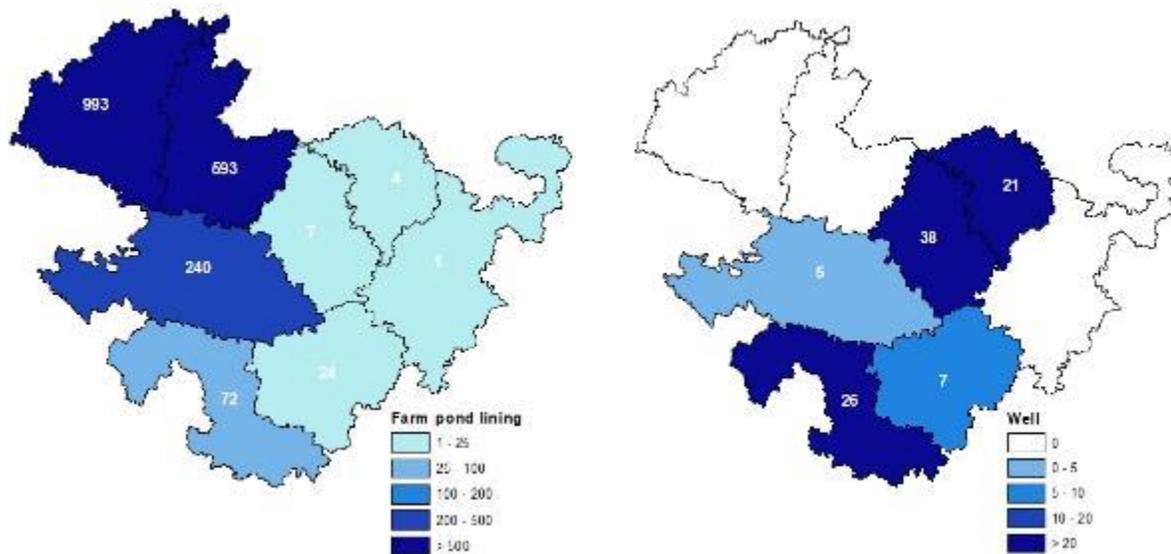


Figure 37 District-wise distribution of adoption of farm pond lining materials by the beneficiaries and new well developed in the project area

### Climate Smart Post Harvest Management and value chain promotion

Activities for storing, processing, transporting of the goods/ produced of the farm are managed through Climate Smart Post Harvest Management and value chain promotion activity under the PoCRA. The farm produce needs the treatment, packaging or other processing for the larger market i.e., from local to international level. Hence considering the fact these activities are promoted in the project area.

There are mainly construction of small and medium size godown for storing the farm produce, seed storage godown, grain processing units, vegetable or fruits processing units etc. Construction of various units are done by tendering process and the further work are monitored through the authorized person. A confirmation regarding non-polluting activity was taken from the vendor and stakeholder. In all the units except vegetable/fruit processing no use of heavy water is observed. A unit Banana processing unit visited at Nanded showed water recycling and non-hazardous chemical for cleaning process. Since the unit exports the banana utmost care for chemical residue is taken.

For small and marginal farmers, the farming activities using advanced or new technologies and equipment's is not a viable option and they go for traditional methods where they loss time and has productivity concern. Use of custom hiring centers has become one of the easy way for farmers to avail various facilities at low cost to save time and increase their productivity (BAIF 2020<sup>46</sup>). It has been observed that the custom hiring centers are worthy in drought prone regions where farmers are continuously facing severe climate shocks hence this activity has become more popular in PoCRA villages and the number of CHC's are increasing in last three years. The project is promoting custom hiring centers, so that small and marginal farmers are

<sup>46</sup> BAIF - 2020. Custom Hiring Centers: Facilitating Inclusive Access to Weather-Resilient Technology.

able to access the costly machines on rent to achieve desired farm productivity without compromising soil health and water use efficiency. This activity supports timely agricultural operations aided by farm mechanization services offered on custom hiring basis. Farm mechanization activities were well adopted by farmers in different districts of the project area (Figure 37)

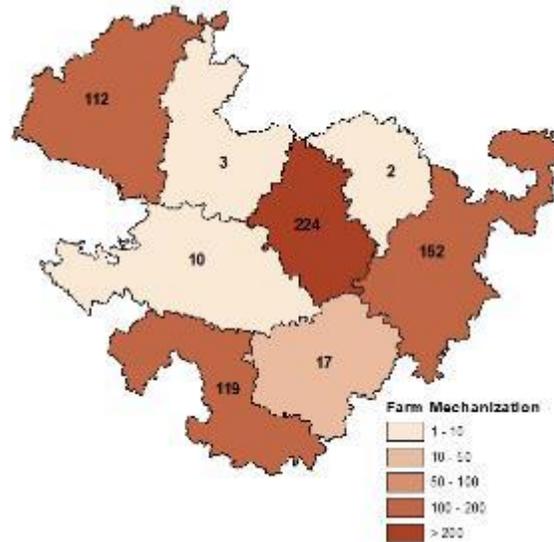


Figure 38: District wise adaptation of farm mechanization activities in the project area

The project is promoting the creation of a supply chain of seeds with climate resilience features like short duration, drought-resistance, and salinity tolerance. The project plans to develop seed hub in project clusters covering a range of operations, including seed production, seed processing, storage, and certification. The project is promoting enhancement in seed replacement ratio (SRR) by supporting farmers to grow foundation and certified seed of climate resilient varieties. 7443 seed production units are developed in the project area under the project (Figure 38).

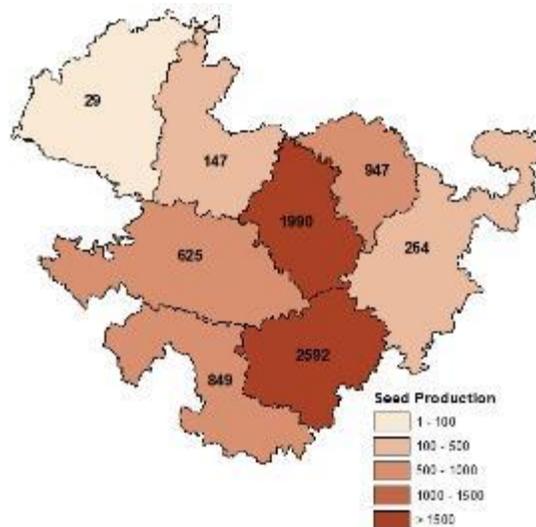


Figure 39: District wise distribution of seed production units developed under PoCRA

### Implementation of environmental management framework

Climate variability and its possible impact on agriculture is well established by national and state level researches. Change in rainfall pattern in different regions of the state were recognized by analysing long term trends. Further, the evaporation appears higher than rainfall in the months of July and August in some of the districts of the state. The state is prone to various disasters and while low rainfall areas of the state are under the constant risk of droughts, high rainfall zones of eastern and western Maharashtra are prone to flash floods and landslides. Many areas of the State have faced droughts for consecutive years.

### Water resources conservation

Water resources conservation strategies were planned under the project. During the environmental audit, implementation of different water management activities were assessed under different districts.

### Promoting Efficient and Sustainable Use of Water for Agriculture

This is one of the major activities under the PoCRA. Catchment area treatment through natural resources management (NRM) activities were undertaken, like continuous contour trench, Deep contour trench loose boulder structure, development of earthen nala bund and cement nala bund (Table 1). Financial and technical support were included to construct community farm pond and individual farm pond with lining material to reduce the water run-off. Community farm ponds are more popular in Hingoli, Jalgaon, Jalna, Latur, Nanded, Osmanabad, and Parbhani. In rest of the districts individual farmer beneficiaries are higher in number. Farm pond is most demanding activity for farmers having land more than 1 or 2ha. An additional benefit of inland fisheries developed by various farmers in the farm pond. Hence more income generation and conservation of resource done through it. Rejuvenation of existing water harvesting structures like artificial recharge of ground water through dug wells, desiltation and repairing of existing water harvesting structures.

Table 56 Activities under Efficient and Sustainable use of water

Activities	Nos. of Physical Components (As on 30 <sup>th</sup> September 2021)
<b>A3.1 Catchment Treatment</b>	
Continuous Contour Trenches (CCT)	14
<b>A.3.2 Drainage Line Treatment</b>	
Construction of nala bunds and structures for treatment of drainage (including Gabion, ENB, CNB)	26
<b>On-Farm Water Security</b>	
• Compartment/ Graded Bunding	334
• Construction of new community and individual farm ponds harvesting	5192
• Repair/desilting of old community and individual farm ponds harvesting	119
• Groundwater recharge structures constructed	11
• Sprinklers and drip irrigation systems installed	124787
• Water pumps and water carrying pipes installed	40352
Rejuvenation of Old Structure	119

Source: MTR draft report (data till 30th Sept. 2021)

It is to be noted that most of the activities related to sustainable use of water under PoCRA is so far undertaken towards the western side of the study area, mainly in Aurangabad and Jalna districts (Figure 7 to 9).

The project districts are lying in drought regions and the basic requirement of farmers for sustainable agriculture is provision of irrigation facility. To achieve this objective along with water harvesting structures, groundwater recharge PoCRA project is focusing on drip and sprinkler irrigation so that water can be reached to every corner of the field. More than 30,000 farmers in Aurangabad district and 20,000 farmers in Jalgaon district has taken the benefit of drip irrigation. More than 5000 farmers has taken benefits of sprinkler irrigation. Farmers in different cases requires things such as water pumps and pipes hence to supplement current irrigation practice benefits were provided for these two components under PoCRA. This activity has helped in conservation of water resource at large.

### **Climate Smart Agriculture and Resilient Farming Systems**

Demonstration of climate smart agriculture through organizing farmers' field school (FFS) was undertaken in different project district. Farm level water management plan for the conservation of run-off water was included in the FFS. Different water resources management strategies e.g. Contour cultivation, broad bed farrow (BBF) cultivation, protective irrigation using farm pond, protective cultivation using shadenet, poly tunnel were demonstrated in the FFS. On average 200 host farmers were participated from each districts, except Osmanabad. Active participation of host farmers' in the FFS indicates that the water conservation strategies under the project are well accepted by the farmers of the project villages. Due to well and well recharge activity water levels for most of areas has been increased that helps in irrigation.

Shed net structures, polyhouse, poly tunnel structures are the more useful structures for climate resilient agriculture system for water conservation. The meagre rainfall and high temperature/heat are the characteristics of the region. Hence to increase productivity and resilient to harsh environment this component is more crucial under the project. Aurangabad, Beed, Buldhana, Jalana, and Parbhani has more than 50 beneficiaries of shed net house in these districts. Shadenet, Polytunnels and open vent poly houses were included as protective cultivation activities under the PoCRA.

### **Conservation of soil**

#### **In-situ soil conservation**

Compartment bunding and contour trench are promoted under the project to mitigate soil erosion.

#### **Address to climate change**

Agroforestry and plantation (fruit crops) activities are promoted through the project to increase carbon sequestration and reduce the emission of greenhouse gas. Soil microbes on soil surfaces can help in degrading the leaves and plant remains, also root functioning helps in extraction of carbon. Under agroforestry mainly bamboo plantation is promoted on the common land areas. It requires less water and attention compared to other plants. It grows in shorter period of time and can be used for multiple purposes in village. It can produce revenue for the village and help for individual as well as for community in various means. The benefits of same are taken in only Aurangabad, Beed, Jalna and Nanded district. The short term gains of agroforestry are comparatively less in economic terms but it has high importance in environmental context for reducing GHG's effect and sequestering carbon.

### **Integrated Farming System**

The livestock census (2012) have reported decrease in livestock population by 9.7%. The PoCRA project activities included Integrated farming system with Poultry, small ruminant, apiculture, sericulture and inland fisheries to increase the agriculture livestock population in the project districts. 2945 beneficiaries in the project areas have adopted to integrated farming system. According to the livestock census (2012), poultry in the state had increased 20.1%, hence Poultry activities were not much adopted by the beneficiaries; however, significant number of farmers have adopted small ruminant (1418), inland fisheries (890) and sericulture (690). Adoption of the integrated farming activities are highest in Aurangabad among the project districts (Figure 6).

### **Integrated nutrient and pesticide management**

Soil nitrogen (N) and phosphorous (P) content in most of the project districts are towards the lower side. Soil conservation measures were undertaken under different activities under the PoCRA. 137 farmers across the project districts have adopted composting/vermicomposting activities under the project to

improve the soil nutrient level. Among different districts highest number of beneficiaries adopted to compost/vermicomposting are in Osmanabad (56) (Figure 39)

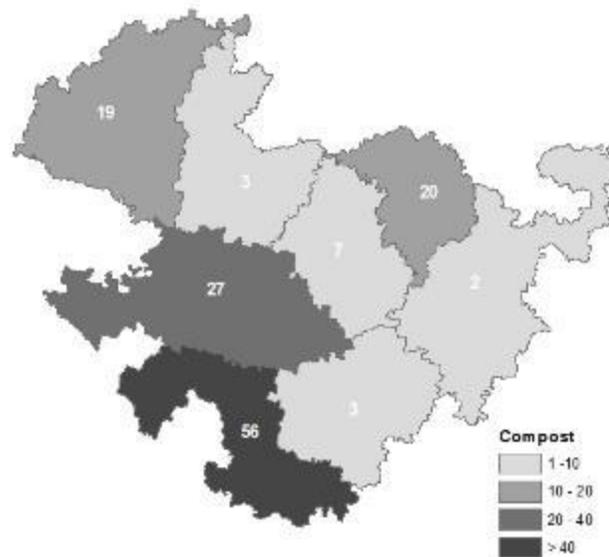


Figure 40: District wise number of beneficiaries adopted composting as integrated nutrient management

Among 2410 surveyed beneficiaries only about 4% was found to use biopesticides in the study area. 6 to 8% of the pesticide using farmers were found to use biopesticides in Aurangabad, Beed, Osmanabad districts (Figure 40).

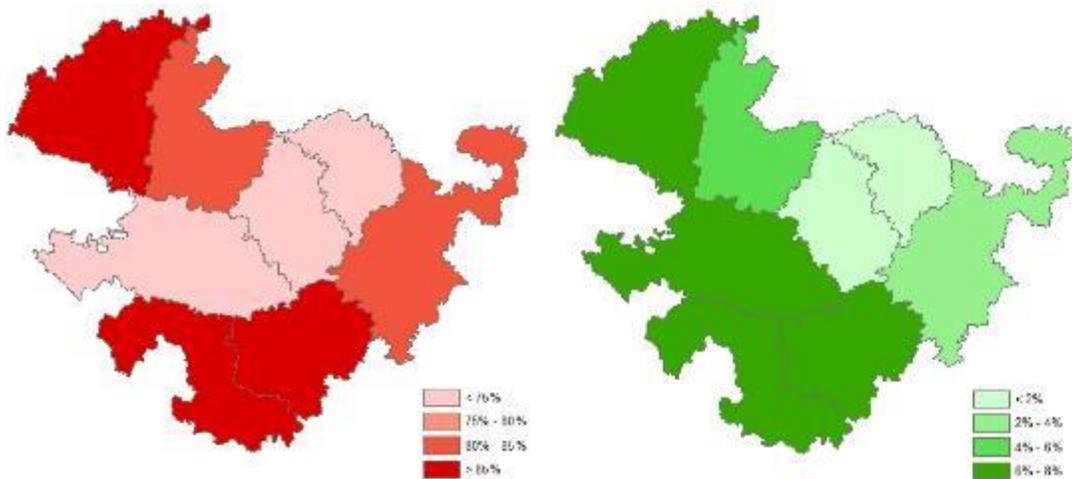


Figure 41: Percentage of surveyed beneficiary farmers (N=2410) using pesticide (Left) and percentage of pesticide user farmers (N=1731) using biopesticide in different project districts

## Environmental screening

### Activity A1 Participatory Development of Mini Watershed Plans

Different natural resources management (NRM) structures were developed under this activity following the mini watershed development plan prepared by the VCRMC. There was no tree felling activities taken place during the construction of the NRM structures in any of the eight districts. All environmental compliance required for the construction of the NRM structures were followed in most of the watershed development plans. In few of the cases, like some cases in Osmanabad district. In most of the cases materials for the construction activities were not arranged locally and documentation related to authorized dealership was not maintained. At least in 25% cases it was not ensured that the construction location was located in a noise free zone. Air quality at the construction sites were not monitored periodically during the construction activity. Majority of construction activities were restricted to day-light-hours, except some cases in Osmanabad and Aurangabad districts.

### Activity A2.1 Climate Smart Agriculture and Resilient Farming Systems

Integrated pest management is one of the important activities under Activity 2.1 of PoCRA. There is an overall decrease in pest attack during the MTR stage compared to the baseline in both Project and Non-Project areas of the study districts (Figure 14).

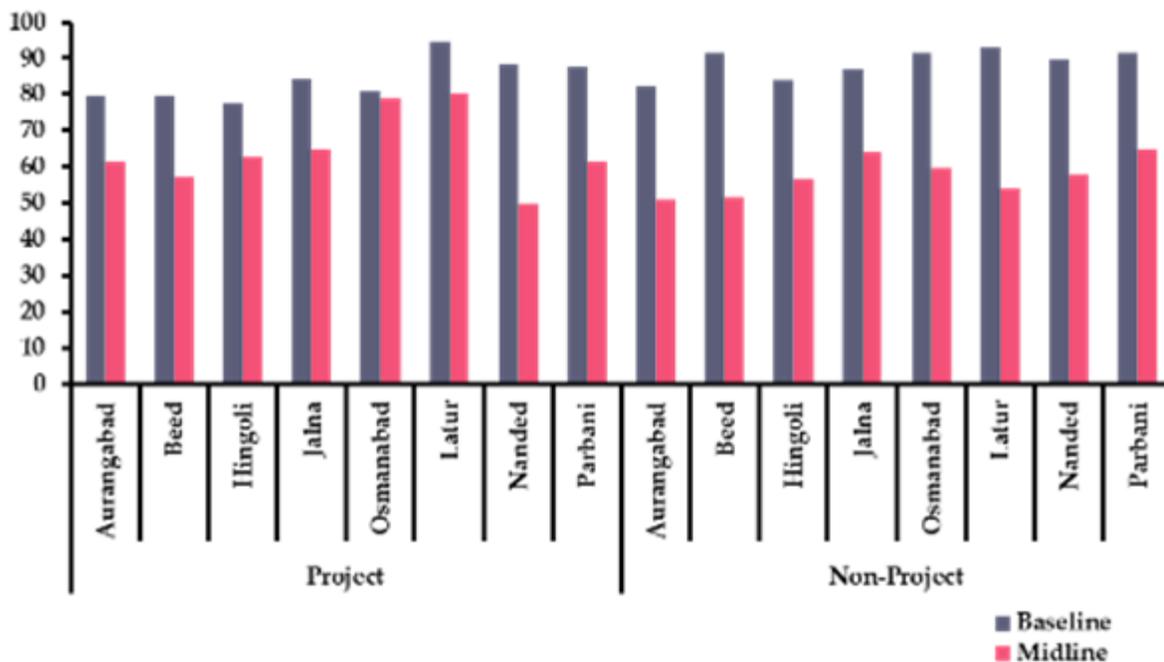


Figure 42 Percentage of surveyed farmers reported pest attack during Baseline and MTR stage in both project and non-project areas

However, it was noted that surveillance of pest attack is average in the project area (Figure 42).

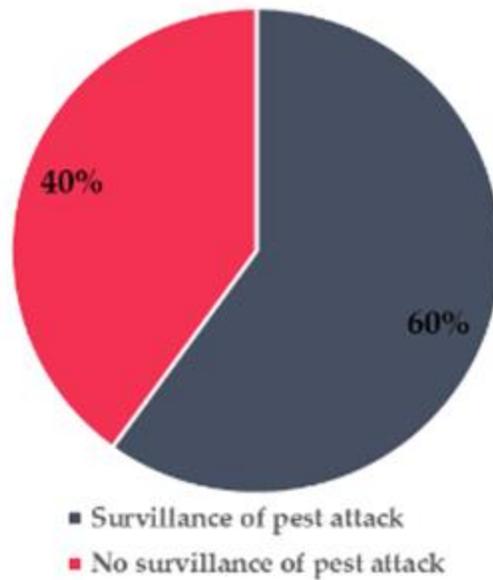


Figure 43 beneficiary response on surveillance of pest attack. (N = 16)

Six percent of the total pesticide users beneficiary farmers (N = 1731) uses biological pesticides. While more than 80% of the pesticide users do not have any knowledge about the pesticide (banned or restricted chemical) they are using in the field. Project beneficiaries in Hingoli (39%), Beed (31%) and Aurangabad (20%) has better knowledge of pesticide (banned or restricted chemical) used in their field, while beneficiaries from Osmanabad (7%) has poor knowledge about the pesticide used.

In all districts, FFS was organized to train the farmers on safe use and safe disposal of pesticides. However, no clear monitoring protocol of beneficiary activity was found from the project staff in all districts. During the household survey of the beneficiary farmers, it was found that at least about half of the beneficiary farmers do not follow any safe disposal guideline for the disposal of pesticides or pesticide containers after use (Figure 43).

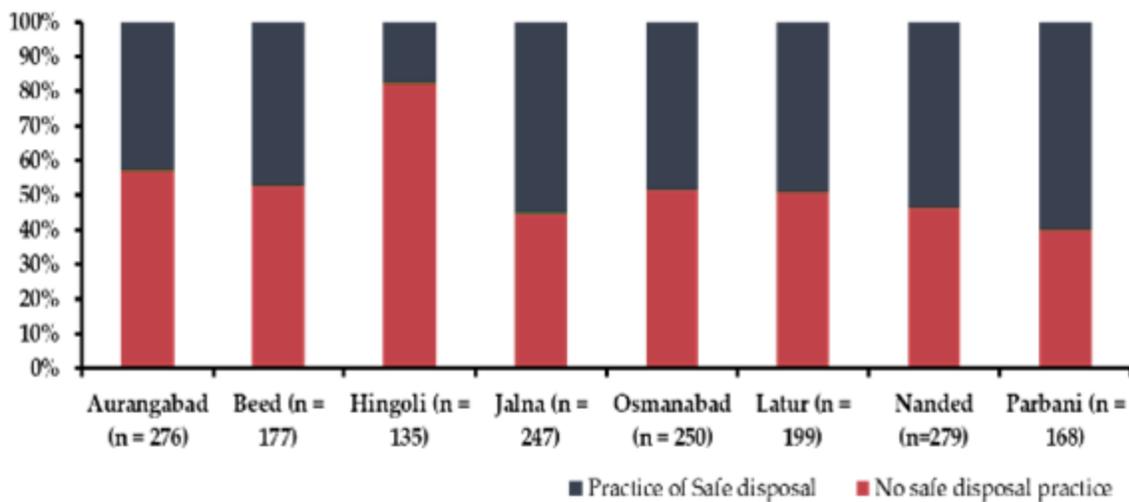


Figure 44: District wise variation in practice of safe disposal of pesticides among the pesticide user beneficiary farmers

About 76% of the beneficiary farmers do not undertake integrated nutrient management guidelines in their field. However, integrated nutrient management was included in the FFS organized in more than 50% of the villages.

### Activity A2.2 Enhancing Carbon Sequestration and GHG accounting

4574 soil testing have already been conducted in the study area during 2018 - 2021. However, in 4029 plots soil testing was conducted once during the four year period (Figure 44). During the beneficiary survey it was noted that the soil testing of the cropland of about 70% beneficiary farmers (N = 2410) have not yet been undertaken. The awareness about soil erosion among the beneficiary farmers is also very poor. About 40% of the surveyed beneficiary farmers in the study district was found to have knowledge on soil erosion. About 50 to 70% people in the study area have undertaken organic cultivation. The beneficiaries in the eight project districts are not aware about GHG accounting and no initiatives were taken to enrich their knowledge on GHG accounting through FFS or other activities.

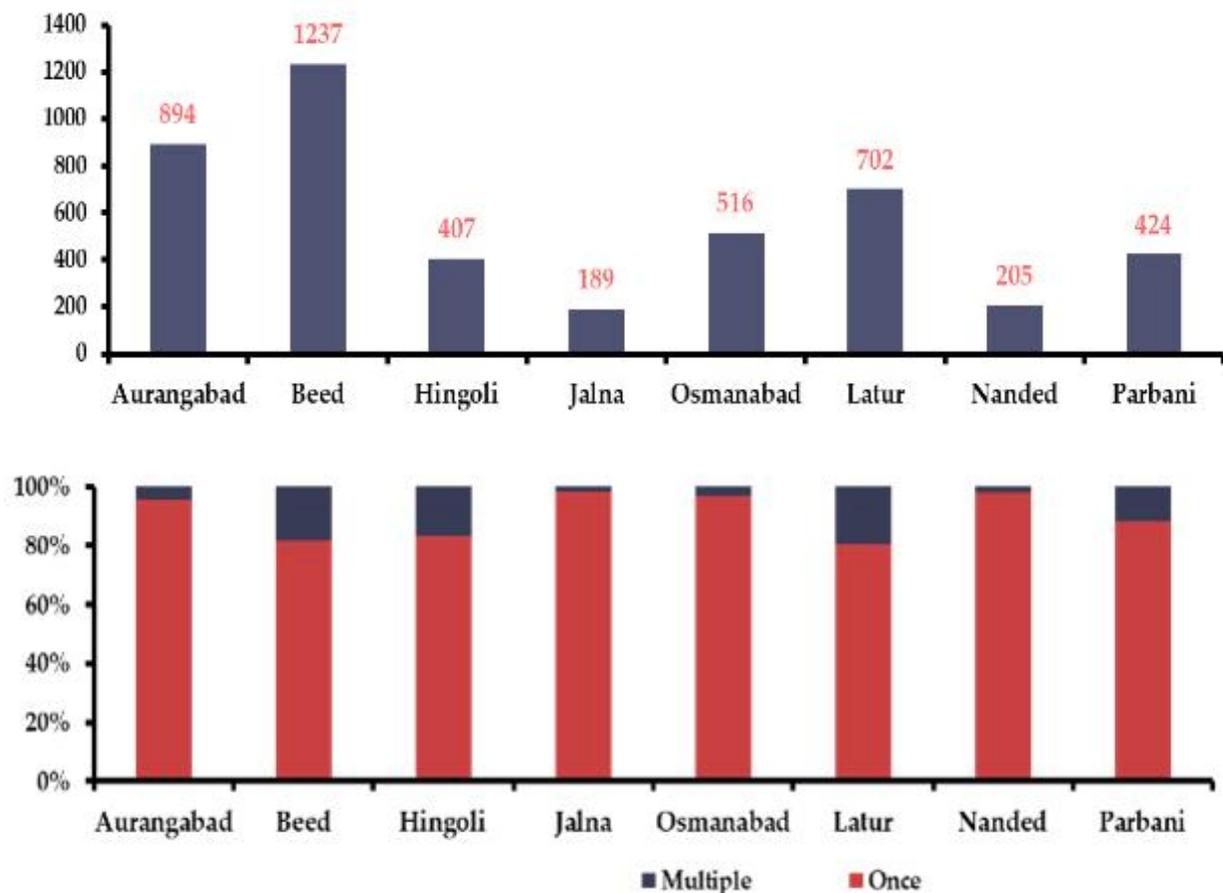


Figure 45 Total soil sample tested (Top) and soil tested once or multiple times of same plot during 2018-2021 in different district

### Activity A2.4 Protective cultivation

More than 90% beneficiaries in the eight project districts uses electricity powered pumps to draw irrigation water. Only about 2% beneficiaries uses the diesel powered pumps and about 1.5% uses solar powered pumps to irrigated the crop land. About 52% beneficiaries use star-rated pumps for irrigation purpose.

Very few (about 1%) of the beneficiaries in the eight districts presently use shadenet or polyhouse for cultivation. Both are mainly use to cultivate vegetables, or sometime as nursery.

### Activity A2.5 Integrated farming system

In some cases, it was found that there was violation of Cruelty Against Animal Act, 1960 while transporting the animals in Latur and Nanded districts as informed by the project staff. In 50% of the districts open grazing land for the animals is assigned. A guideline for the disposal of dead animals' carcasses exists in Jalna, Aurangabad, Hingoli and Osmanabad districts. Disease transmission from wild animal to farm animal was reported in Hingoli, Parbani, and Beed districts. However, except Osmanabad, vaccination of farm animals was taken care of by the PoCRA in all districts.

### Activity A3 Promotion of sustainable use of water in agriculture

In none of the districts, any dug well were developed with more than 60 m depth and all check dams constructed as the NRM activities under the project were less than 10 m height.

Most of the beneficiary farmers do not have the water harvesting structures (Figure 45). Some of the beneficiary farmers also uses borewell for the purpose of water harvesting.

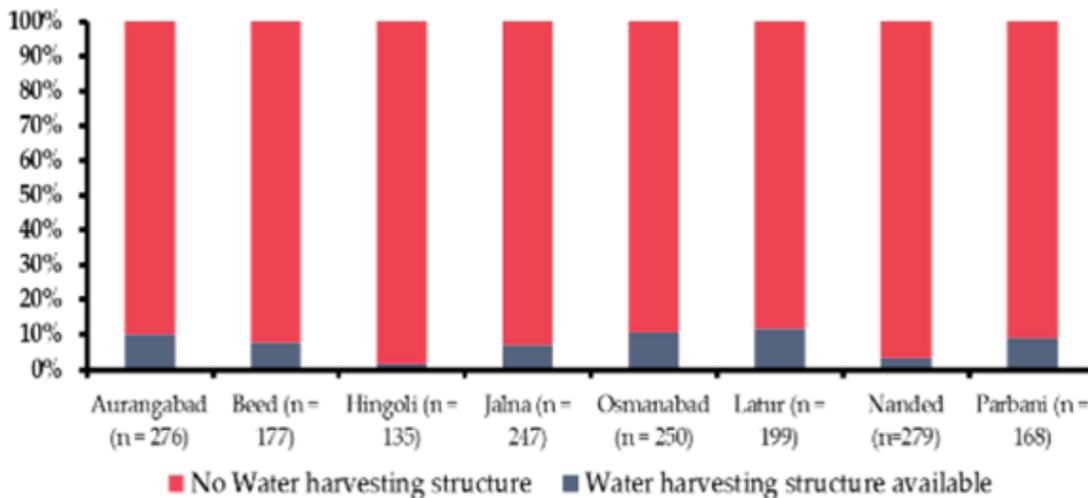


Figure 46: District wise availability of water harvesting structures among the beneficiary farmers

More than 90% beneficiaries uses PVC pipes. Adaptions of protective irrigation system among the beneficiary farmers are not significant among beneficiaries. Adoption to protective irrigation was found much higher in Hingoli district (~36%) compared to others (Figure 46). Among the beneficiary farmers, flood irrigation practice was higher in Osmanabad (66%) followed by Jalna (52%) districts (Figure 46).

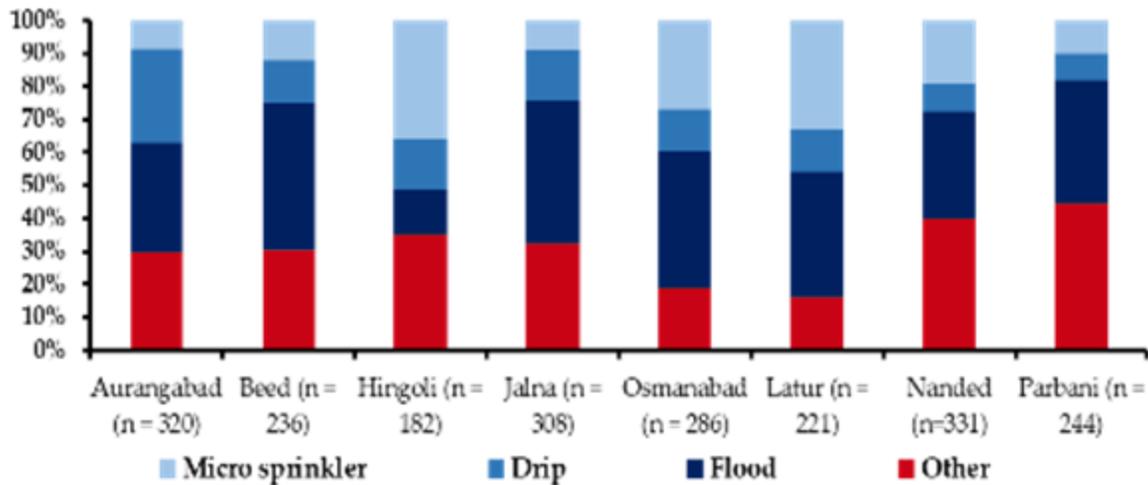


Figure 47: District-wise variation in use of irrigation systems among the beneficiary farmers

Table 57 General Environmental Screening of the project

Environmental Aspect	Generic Mitigation Measures	Remarks
Site Selection & Materials	<p>The site selected for the activity must not be in areas that are: wildlife conflict areas, waste dumpsites, highly polluted/contaminated land or water areas, natural drainage courses, areas prone to floods.</p> <p>Ensure that material required for construction of bunds, nala bunds, water harvesting structures, etc., is procured on-site or from authorized quarries.</p>	<p>None of NRM construction activity sites were near to the wildlife area, archeological conservation area, waste dumpsites, highly polluted/contaminated land or water areas, natural drainage courses or areas prone to floods.</p> <p>Materials for the construction of the NRM structures were not arranged from the local sources; however, the contractors were arranged the required raw materials. There is no information whether these were arranged from authorized quarries or not.</p>
Resource Conservation	<p>Adopt water conservation practices (e.g., use of efficient irrigation methods such as drip and sprinkler irrigation, mulching, alternate furrow irrigation, etc.).</p> <p>Avoid wastage and over-consumption of water (e.g., avoid crops that are water intensive, avoid over-extraction of groundwater).</p> <p>Adopt renewable energy alternatives where feasible (e.g., solar lights, solar water pumps, etc.).</p> <p>Adopt energy efficient agri-machinery (e.g., BEE 5 star rated pumps).</p>	<p>Use of protective irrigation among the beneficiary farmers is lacking. About 37% farmers in the project villages use protective irrigation system. The project has not facilitated the use of solar-powered pumps. Most of the pumps used by the beneficiaries are run by electricity. However, PoCRA project has assured that only BEE 5 star rating pumps are used by the beneficiaries</p>

Environmental Aspect	Generic Mitigation Measures	Remarks
Pollution Control	<p>Ensure that all vehicles have a valid Pollution Under Control certification.</p> <p>Ensure that all generator sets (diesel, petrol, kerosene, LPG, CNG) meet the 'CPCB noise and emission control standards for Generator Sets'.</p> <p>Ensure that noise generating activities meet the CPCB prescribed 'Ambient Air Quality Standards in Respect of Noise'.</p> <p>Avoid release of waste water into water bodies, streams, etc., without any treatment.</p> <p>Ensure that all waste water meets the 'CPCB General Standards' prior to disposal.</p> <p>Ensure that all machinery conforms to noise standards. Compost organic wastes.</p> <p>Dispose non-biodegradable wastes at locations specified by the local government body (e.g., proper disposal of waste plastic mulch).</p> <p>Avoid burning of wastes (crop residues, leaf litter, plastic wastes, etc.).</p>	<p>All vehicles used during the construction of NRM structures were having valid Pollution Under Control certification.</p> <p>No information related to noise and emission control standards for the Generator sets used for the construction activity was available.</p> <p>It was mentioned during the survey of the VCRMC and Agriculture assistant that it was ensured the noise level during the construction activities were within the CPCB prescribed standard limit; however, no clear dataset was available/maintained. There was no specific on site monitoring of machineries used for the NRM structures related to noise standards.</p> <p>There was not much waste water from the construction sites, that required pre-treatment before discharging to local water streams.</p> <p>Waste burning issues was not addressed during the project activity. Crop residue burning was recorded in the project villages and it was also noted that there is no existing guideline for safe disposal of used plastic bottles, bags of fertilizers or pesticides.</p>
Air Quality	<p>Construction activities (especially excavation work) will be undertaken in the dry season.</p> <p>Periodic monitoring of air quality, including noise levels, will be undertaken during the construction phase.</p>	<p>Construction activities were taken during the dry season. The disturbed are of soil stock pile were kept moist through out the construction period to reduce the dust emission. However, there was no monitoring of air quality around the construction sites during the period of construction.</p>
Biodiversity Conservation	<p>Avoid felling of existing trees.</p> <p>Avoid cultivation/rearing of exotic species of animals or plants.</p>	<p>There was no reported tree falling activities during the project activities. Rearing of exotic species was avoided during the implementation of agro-forestry activity in the project.</p>
Health and Safety	<p>Adopt prescribed safety practices, including use of personal protection equipment (PPE), for handling, storage, use and disposal of pesticides (refer to Pest Management Plan).</p> <p>Adopt prescribed safety practices, including use of personal protection equipment (PPE), for handling any machinery.</p>	<p>During the survey, it was found that most of the beneficiary farmers used protective safety gears during the use of pesticides.</p> <p>However, no clear information was revealed related to PPE use during the operation of machinery in the agriculture field.</p> <p>Most of the cases, no fencing was found around the water storage structures like</p>

Environmental Aspect	Generic Mitigation Measures	Remarks
	Ensure that all pits, holes, water wells, farm ponds developed under the storage structures, etc., must be adequately secured to prevent accidental falls.	PoCRA.

### Environmental audit for value chain infrastructure

Evaluation of measures to remove or reduce the potential negative environmental impacts of Activity B - post-harvest management and value chain promotion are given in Table 6.

Table 58 Environmental audit for value chain infrastructure

Environmental Aspect	Impact	Project implementation
Site Selection	Improper location can have multiple impacts on sustainability, biodiversity, disaster proofing, etc.	All sites selected for the activity was not in areas that are: wildlife conflict areas, waste dumpsites, highly polluted/contaminated land or water areas, natural drainage courses, areas prone to floods.
Felling of trees and clearing of vegetation	Loss of green cover including trees	No felling of tree was reported during the construction of the value chain infrastructure.
Construction materials	Unregulated quarrying can result in over-extraction, impact on natural drainage, soil erosion, loss of aesthetic appeal of the land scape, etc. Over-extraction of water for construction could lead to local scarcity.	Construction material was arranged by the contractor. However, there is no information on the material borrowed from authorized quarries or not. Extraction of water kept limited during the implementation of the construction activity.
Pits and boreholes	Risk of falls into unsecured pits, boreholes, etc.	Boreholes were 2 m in depth. However, there was no security fencing around the pit or bores.
Health & Safety	Risk of accidents at worksite.	Use of PPE at the site was not found during the visit. In none of the visited sites, first aid was available.
Air Quality	Dust emissions from excavation. Emissions from vehicles and machinery, dust, etc., may lead to air pollution. High noise levels from construction activities may lead to noise pollution. Air and water pollution from processing units (grain and pulse processing, flour mills, etc.)	Construction activities (especially excavation work) was undertaken in the dry season. Adequate measure was taken to protect the top soil. No air quality data during the construction phase of the value chain infrastructure were available. All manufacturing processes will comply with the relevant CPCB standards: industry specific standards for 'Grain Processing, Flour Mills, Paddy Processing, Pulse Making or Grinding Mills, or, in cases where industry-specific standards are not relevant/available, with the CPCB General Standards.

Environmental Aspect	Impact	Project implementation
Water Quality	Runoff and release of untreated wastewater may pollute nearby water bodies.	Water treatment facility was not available with the value chain infrastructure.
Waste Management	Pollution and health impacts due to improper disposal of wastes such as open dumping, burning, unauthorized recycling, etc.	No hazardous waste was generated during the construction activities. However, there was no clear plan to dispose the solid waste materials generate during the operational activity of the infra unit.
Energy Consumption	Equipment and machinery that is not efficient will lead to energy wastage and higher operating costs.	It was ensured that all machinery or equipment use in the infra unit should be BEE 4 or 5 star rated.

### Implementation of Environmental Management Plan

#### Solid Waste Management

The survey found that only 10% of beneficiaries who have received subsidies w.r.t. farm ponds (under activity A.3.4.2) in the project area understand safe disposal of the lining materials of the farm ponds. About 40% of the surveyed beneficiaries (under activity A.2.1.4) in the study area (Figure 47) reported that they generally dump the waste irrigation pipes, lining materials etc. as these have no other use. The dumped material is generally set on fire over time.

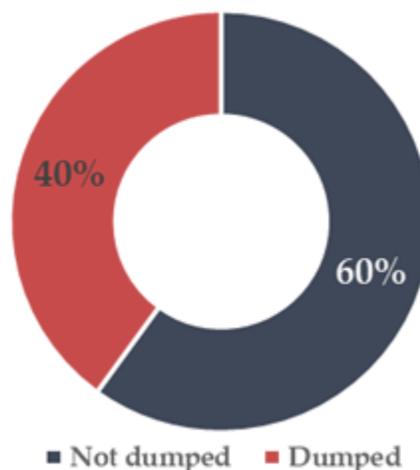


Figure 48: Solid waste management status among beneficiary farmers

All surveyed beneficiaries who have received support related to protective cultivation like shadenet, polyhouse etc. (under activity A.2.4), have no information about safe disposal of polythene materials used

in the protective cultivation structure after its end of life. Integrated pest management is an activity under A.2.1. More than 50% of the beneficiary farmer do not follow any safe disposal practice of the empty pesticide container.

Management of post-harvest crop residues and residues from the agroforestry in the farm periphery (under activity A2.2.1) is an important problem in the project area. In all districts, more than 50% of the post harvest crop residues are either burnt or dumped aside (Figure 48).

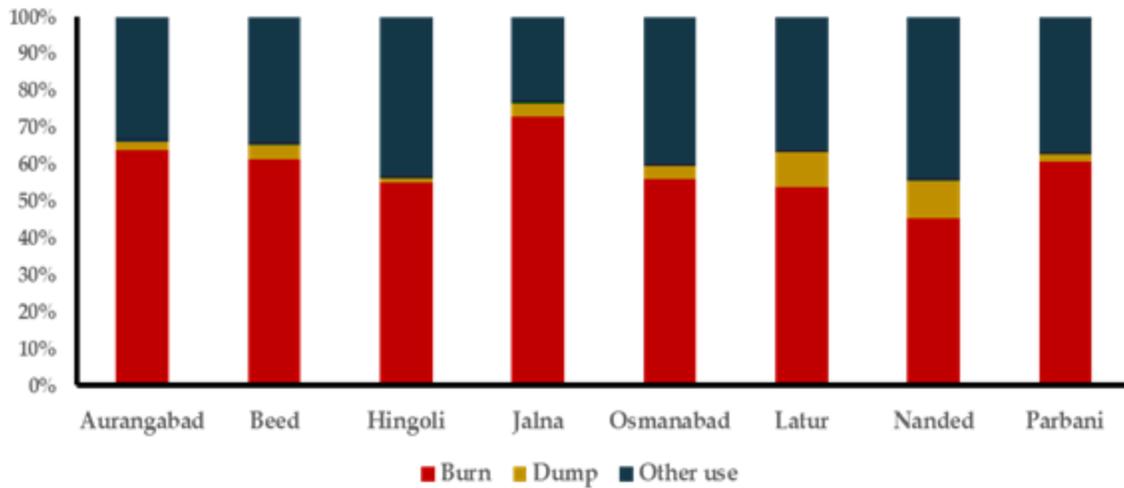


Figure 49: District wise management of post-harvest crop residues

Based on the above analysis the conclusion related to solid waste management in the project is given in Table 50.

Table 59 Status of solid waste management in the project

Solid waste	Scale of Impact	Probability of occurrence
Pollution due to improper disposal of solid waste (e.g., plastic mulch)	High	High
Improper disposal of hazardous waste (e.g., pesticide containers)	High	High
Improper disposal of biological waste (e.g., dead animal carcasses)	Not applicable	Not applicable
Improper disposal of organic waste (e.g., burning of crop residues, open dumping of manure)	High	High

### Water Pollution

On Average, 22% of beneficiary farmers rinse the empty pesticide bottles with water after use. Atleast 47% of the beneficiary farmers who uses pesticides wash the empty bottles in rivers. This may lead to pollution of surface as well as the ground water. Among different districts, the beneficiary using waterbodies to clean the pesticide bottles follows the order; Latur (78%) Osmanabad(6%) > Parbani (59%) > Jalna (53%) > Beed(46%) > Aurngabad (42%) > Nanded (25%) > Hingoli (17%) (Figure 49).

Possibility of water pollution due to different project activities are given in Table 5.

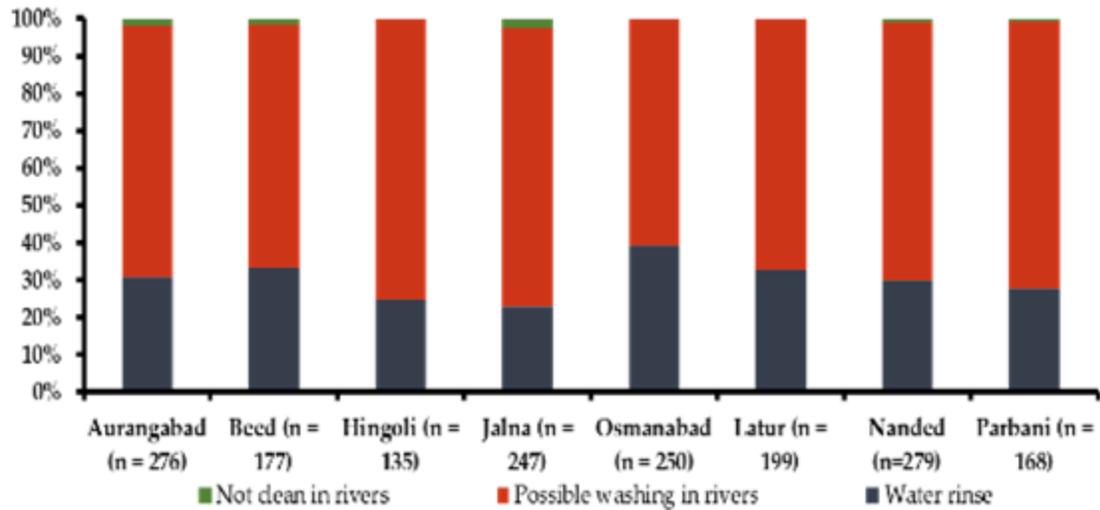


Figure 50: practice of disposal of waste pesticides by the beneficiary farmers uses pesticides in different districts

Table 60 Impact of project activities on water pollution and water availability

Indicator	Scale of Impact	Probability of occurrence
Pollution of water bodies due to release of waste water	Medium	High
Pollution of water bodies due to leaching of excess fertilizer or manure	Low	Low
Pollution of water bodies due to excess fish feed	Low	Low
Depletion of groundwater due to over-extraction	Low	Low
Reduction in down stream flows due to diversion/damming/bunding of streams/rivulets/nallas	Low	Low

### Health & Safety

The construction sites in all districts were not equipped with the First-Aid box. The VCRMC in different villages of Latur, Aurangabad and Hingoli reported that the First-Aid box was not provided during the NRM construction activities in their villages.

More than 60% of the beneficiaries who have received the benefit under activity A.3.4 informed that there is no fencing around the water storage structure developed under PoCRA.

More than 90% of beneficiaries under Activity 2.5 informed that they have not received any guideline related to transport, maintenance of the ruminants. Construction related health and safety risks during the project implementation are given in Table 61.

Table 61 Health and safety related issues during the implementation of the project

Indicator	Scale of Impact	Probability of occurrence
Safety risk from improper storage and/or handling of hazardous chemicals	Medium	Low
Safety risk from unguarded wells, borewell holes, farm ponds, etc.	High	Low
Risk of transmission of zoonotic diseases (e.g., bird flu, anthrax)	High	Low
Accidental injury	High	Low

## Implementation of Social Management Framework

### Activity A1.1 Participatory Development of Mini Watershed Plans

A total of 3821 VCRMCs have been constituted in the PoCRA project villages till now. A VCRMC consists of a total of 13 members and of the total at least 7 members are women. Out of the total 49673 members (in 3821 VCRMC), 26747 are women members and are involved in the various decision-making processes of the VCRMC.

FGD with VCRMC was conducted in 16 project villages (2-3 village from each of 8 district). Out of 16 villages in 25% of VCRMC members have not participated in the microplanning process. The panchayats in these villages were newly formed (January to September 2021) and since VCRMC acts as a sub-committee of the gram panchayat, the new batch was yet to receive any training on the role and responsibilities of VCRMC. Moreover, in some of the on-line training conducted by POCRA team, many members were unable to attend since they did not have smart phones or faced connectivity issues.

The VCRMC of all the villages except one (in Nanded district) where FGD was conducted are aware of the beneficiary prioritization criteria or the inclusiveness system inbuilt in the DBT application.

Before approving the village level micro plan all the villages surveyed except 10% has ensured if micro plan is prepared taking into account the assessment of available resources in the village, social and holding categories of people.

The FGDs with Agriculture Assistant (AA) of all villages across districts revealed that out of these 80% villages have involved external third-party agency in micro planning process.

Around 90% of AA with whom FGD was conducted mentioned analysis of village profile (covering socio economic, geo-physical, agriculture, livestock) and constraints (pertaining to water status, soil health, crop production, marketing, social, gender) during participatory village level plan development.

When asked to AA about whether special needs of small holders, SC/ST farmers and women farmers have or have not been taken into consideration during the microplanning process. All the villages have considered this inclusion except one village in Osmanabad district and two of the villages in Nanded and Beed villages which do not have the SC/ST population.

During the FGDs with beneficiary around 25% of them (in districts Nanded, Latur, Hingoli and Aurangabad) stated that they are not aware about the micro-planning exercise conducted in their village. /

For better implementation of the project activities the VCRMCs have nominated around 3933 Krushi Tai's in project area who will work as female mobilizer and catalyst between village and project implementers.

### Activity A2.1 Participatory Demonstration of climate resilient agronomic practices (CRAP) dry land farming

According to the PMU records, a total of 69237 capacity building exercises (including training and workshops) were conducted in the project area. In these trainings and workshops around 28% of women farmer participation was seen for various activities such as NRM, soil & water conservation, livelihood entrepreneur activity, digital literacy & technology etc.

From the PMU records, during 2021-2022, in the FFS conducted in all the districts around 23% of host (of FFS) are women. If we look at district wise numbers Aurangabad has the maximum percentage share of women farmer (31%) as host of the FFS. Only 15% of guest farmer in year 2021-2022 are women from all the PoCRA districts. Of all the districts, Hingoli has the least women participation (~8%) in the FFS as compared to other districts.

District	Host Farmer (2021-22) %		Guest Farmer (2021-22) %	
	Female	Male	Female	Male
Aurangabad	31	69	12	88
Beed	16	84	13	87
Hingoli	26	74	8	92
Jalna	19	81	9	91
Latur	22	78	33	67
Nanded	23	77	14	86
Osmanabad	26	74	19	81
Parbhani	18	82	10	90

As per the PMU records (till September 2021) a total of 170 FFS in Hingoli and 354 FFS in Nanded was organised in the tribal areas each district.

The women participation was around 5% in Hingoli district and 17% in the Nanded district (Table 62).

Table 62 FFS conducted in Tribal Area

District	FFS	Guest Farmer	Women guest Farmer
Hingoli	170	2974	141
Nanded	354	7563	1251

During the FGDs conducted with the AAs of the selected villages it came across that in the FFS conducted in the villages, there was participation from all social and holding categories. Also, there was exclusive FFS session held for women farmers in the FGD conducted villages

The project staff/AA in all the FGD conducted villages interviewed also affirmed on providing handholding support and on farm guidance to all social and holding categories according to their requirement.

All the VCRMS conducted FGD except villages of Nanded have accepted taking any additional efforts to mobilize and motivate farmers from vulnerable social groups (SC/ST) and women farmer to participate in the FFS.

When asked participation in the FFS to the beneficiaries in the FGDs, 25% responded that they have never participated in any of the FFS.

One of the challenge that is most cited by the farmers in the household survey across the social categories is the lack of awareness about the FFS or the timings of FFS gathering (Table 63). Similarly, across the districts lack of awareness on the FFS or the timings of the FFS is the biggest challenge faced by the

Table 63 Challenges for not participating in the FFS under PoCRA

Social Categories	Total Farmers	Not aware about FFS/not aware about the timings (%)	Work in field/Personal Work (%)	FFS not useful (%)
General	1224	19	13	2
Nomadic Tribe	235	32	10	1
Other (Muslim/Maratha/VJNT/Matang Samaj/Bhil)	83	24	16	4
Other backward class	448	22	11	4
Scheduled caste	257	28	19	2
Scheduled tribe	161	28	14	8

Table 64 Challenges for not participating in the FFS under PoCRA by Women farmer

	Not aware about FFS/not aware about the timings (%)	Work in field/Personal Work (%)	FFS not useful (%)
<b>Women Farmers (n=146)</b>	29	10	5

### Activity A2.2 Enhancement in carbon sequestration

Any of the SC/ST category farmers have not applied for the agroforestry benefits in any of the districts (Table 65).

There are very few marginal (n=28), small farmers (n=35) and women farmers (n=15) in Aurangabad who have received the benefits from this activity.

Table 65 Agroforestry applied through DBT in different districts

Agroforestry	Individual (General/SC/ST)			Individual farmer (Small/marginal/large)			Individual (male/female)			
	General	Scheduled Caste (SC)	Scheduled Tribe (ST)	Landless	Marginal	Other	Small	Female	Male	Other
Aurangabad	76	0	0	0	28	13	35	15	61	0
Beed	2	0	0	0	0	2	0	0	2	0
Nanded	4	0	0	0	1	2	1	2	2	0
Osmanbad	0	0	0	0	0	0	0	0	0	0
Latur	0	0	0	0	0	0	0	0	0	0
Jalna	10	0	0	0	1	6	3	2	8	0
Hingoli	1	0	0	0	1	0	0	1	0	0
Parbhani	0	0	0	0	0	0	0	0	0	0
<b>Grand Total</b>	<b>93</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>31</b>	<b>23</b>	<b>39</b>	<b>20</b>	<b>73</b>	<b>0</b>

Source: PoCRA PMU, September, 2021

In the FGDs with the beneficiary only 18% of the beneficiary have stated receiving any training related to agroforestry plantation activity and only 12% have experienced any benefits of it.

## Activity A2.4 Protected Cultivation

During the FGD with the beneficiaries it came across that around 44% did not receive any training/technical guidance for using protected cultivation technology. On the question of if they face any difficulty in getting matching grant for undertaking protected cultivation, only 25% of the beneficiaries in the FGD faced it. And only 18% of the beneficiaries (in Parbhani, Osmanabad, Beed) receive any support from VCRMC members in accessing credit for adopting protected cultivation.

Of all the registered SC/ST farmers for the benefits there are very less farmers in the SC/ST categories that have opted for the protected cultivation in their farms (Table 66).

Table 66 Beneficiary of Protected cultivation (Pipes, Planting material in polytunnels / Polyhouse / Shadenet house, Polyhouse, Shadenet)

District	Individual (General/SC/ST)		
	General (%)	Scheduled Caste (SC) (%)	Scheduled Tribe (ST) (%)
Beed	10	3	3
Nanded	4	1	0
Osmanabad	2	1	2
Latur	5	1	2
Jalna	1	1	0
Hingoli	10	2	1
Parbhani	5	3	4

Around 64% of the VCRMC committee members have stated in the FGD that they have taken any additional efforts to mobilize and motivate farmers from vulnerable social groups (SC/ST) and women to adopt protected cultivation.

## Activity A2.5 Integrated Farming System

Integrated farming system will be helpful to vulnerable families for improving their livelihood. For livelihood supportive activities under Integrated Farming System small ruminants are the most preferred by SC/ST categories across all the project districts (Table 65). Further, Aurangabad and Osmanabad are the two districts where these activities are most promoted (Table 66).

Table 67 Beneficiary of Integrated farming system

Activity	Individual (General/SC/ST)		
	General	Scheduled Caste (SC)	Scheduled Tribe (ST)
Apiculture	54	0	0
Backyard Poultry	8	6	0
Inland Fisheries	826	19	5
Sericulture	569	46	3
Small ruminants	736	583	48

Table 68 District wise integrated farming beneficiary

District	Individual (General/SC/ST)		
	General (n)	Scheduled Caste (SC) (n)	Scheduled Tribe (ST) (n)
Aurangabad	1001	197	34
Beed	301	93	6
Nanded	14	17	1
Osmanabad	190	247	10
Latur	68	38	3
Jalna	542	73	5
Hingoli	59	21	2
Parbhani	18	5	0

### Activity A2.6 Soil Health Improvement

Through the adoption of good agricultural practices to improve soil fertility, soil nutrient management, a number of activities are promoted under the PoCRA project. Vermicompost and NADEP, organic units are also supported in the project for different social and holding categories. Marginal land holding farmers have availed much of this benefit in the social and holding category and also in Osmanabad this activity has been supported the most (Table 69).

Table 69 District wise Vermicompost and NADEP, Organic unit beneficiary

District	Individual (General/SC/ST)			Individual (Small/marginal/large farmer)				Individual (male/female)		
	General	Scheduled Caste (SC)	Scheduled Tribe (ST)	Landless	Marginal	Other	Small	Female	Male	Other
Aurangabad	18	1	0	0	7	3	9	1	18	0
Beed	27	0	0	0	12	2	13	4	23	0
Nanded	1	1	0	0	1	1	0	1	1	0
Osmanabad	55	1	0	0	16	5	35	9	47	0
Latur	3	0	0	0	0	0	3	0	3	0
Jalna	3	0	0	0	2	0	1	0	3	0
Hingoli	18	1	1	0	8	3	9	4	16	0
Parbhani	7	0	0	0	1	1	5	2	5	0

It can be clearly noted from the table 70 that awareness on soil testing is low among all social categories especially among the SC/ST categories. Also, the table 16 indicates that there are very few farmers (<6%) who currently have soil health cards. Most of the farmers (>90%) have not got their soil tested done.

Table 70 Awareness on soil testing across social categories

Social Categories	Awareness on soil testing (%)	
	Yes	No
General	35	65
Nomadic Tribe	25	75
Other (Muslim/Maratha/VJNT/Matang Samaj/Bhil)	37	63
Other backward class	32	68
Scheduled caste	31	69
Scheduled tribe	36	64

Table 71 Beneficiaries with Soil Health Card

Social Categories	No, never got soil-testing (%)	Yes, currently available (%)	Yes, but not available currently (%)
General	92	2	6
Nomadic Tribe	97	1	1
Other (specify)	96	1	3
Other backward class	93	2	6
Scheduled caste	95	1	5
Scheduled tribe	96	0	4

### Activity A3.1 Catchment treatment/Drainage line treatment

Around 62% of the project staff (AA) in the FGD have stated at least one of the NRM works (Earthen Nala Bund, Cement Nala Bund, Loose boulder structure, Continuous Contour Trenches) undertaken in their villages under PoCRA project. Half of the beneficiary in the FGDs have acknowledged experiencing benefits from the NRM structures constructed in their village and half have experienced none.

### Activity A3.2 Construction of new water harvesting structures

Table 72 shows of the total application received and presentation very few application are for the community farm ponds (less than 1%) and for individual farm ponds (2-3%).

Table 72 Water harvesting structures applications among different social categories

Social Categories	Community Farm Pond		Individual Farm Pond	
	Active applications (%)	Active Presentations (%)	Active applications (%)	Active Presentations (%)
General	<1	<1	3	3
SC	<1	<1	3	3
ST	<1	<1	2	2
Women			3	2

### Activity A3.3 Micro irrigation systems & Activity A3.4 Protective irrigation

Under the project area women farmer and low land holding farmers are supported by micro irrigation system; water pumps and pipes for irrigation purpose based on their needs. There is a fair percentage of

beneficiaries who has availed this activity across low holding and different social categories. Even 20-35% of marginal and small women farmers are also supported by drip, sprinkler, pumps and pipes at their fields (Table 73-75).

Table 73 Micro irrigation support under PoCRA to different land holding

Drip irrigation		
	Female (%)	Male (%)
Marginal	35	30
Small	29	27
Sprinkler irrigation		
	Female (%)	Male (%)
Marginal	27	32
Small	28	33

Table 74 Micro irrigation and protective irrigation support to social categories

Drip irrigation	
	Beneficiaries (%)
SC	19
ST	28
Sprinkler irrigation	
	Beneficiaries (%)
SC	27
ST	36
Water pumps and carrying pipes	
	Beneficiaries (%)
SC	21
ST	22

Table 75 Water pumps and carrying pipes support under PoCRA to different land holding

Water pumps and carrying pipes		
	Female (%)	Male (%)
Marginal	21	22
Small	18	19

### Activity B1.1 Strengthening of Farmer Producer Companies

PoCRA project is attempting to strengthen the commodity specific farmer groups and farmer producer organisations. In the IDIs with 24 project villages it came across that around 80% of the FPOs have received trainings/exposure guidance for effective operations of unit in their areas. Around 20% of FPOs (with IDIs were conducted) in districts of Nanded, Aurangabad and Hingoli have never received any training/exposure guidance.

According to the PMU records, from the 854 FPO/PPC/FIG in the project area a total of 756 women members have been benefitted for various agri-businesses activities. The project has disbursed an amount of around Rs.83.89cr to women members for agribusiness enterprises.

### Activity B1.2 Establishment of Custom Hiring Centres

CHCs were enquired about the access of the units to farmers including women from vulnerable social groups (SC/ST) in the IDIs and around 90% of them have affirmed the access of the vulnerable social groups. Also, around 70% of CHCs even have kept farmer friendly farm equipment in their CHC.

### Activity B.3 Production of foundation & certified seed of climate resilient varieties

There are very few women farmers supported under the project for seed production activity. However, in Latur and Parbhani district over 15% women beneficiaries are supported under the activity.

Table 76 Women beneficiaries supported by PoCRA on seed production

Districts	Women beneficiaries (n)	Women beneficiaries (%)
Aurangabad	4	<1
Beed	99	4
Nanded	41	3
Osmanabad	149	4
Latur	482	15
Jalna	25	<1
Hingoli	145	5
Parbhani	481	18

## Key observations

### Performance of VCRMC

- VCRMC was formed in the year 2020/2021 – Bank accounts are opened
- VCRMC meetings were conducted mostly once in a month. The main activities undertaken -
  - review of project progress in their village
  - guidance to farmer regarding application for matching grant
  - approval of the application
  - payment information and liaison with department for payments
- The key documents maintained by VCRMC -
  - Records/minutes of meeting, visitor register and documents related to individual applications
- VCRMC are actively working to ensure the marginalized are benefitted from the project through awareness generation regarding DBT system and facilitating registration and application process through portal/mobile.
  - Awareness generation about project activities often undertaken through announcements in temple during festivals and fairs
  - Agriculture assistants attend VCRMC meetings to facilitate application process and also they undertake spot visits
- Majority of applications were support for micro-irrigation systems (drip/sprinkler) and horticulture plantations. Few applications are solicited for farm ponds and shade net
  - Time taken for pre-sanction since the time of application is around 2 months
  - Often farmers get micro-irrigation systems from shopkeepers on goodwill and the payment will be made to them only after the disbursement
- No major conflicts reported amongst VCRMC members. Transparency is maintained and all activities/developments (pre sanction, sanction, training etc.) are communicated to the beneficiary through WhatsApp groups that is specifically created for POCRA activities
- Most of the times women do not have land in their names, so by and large they are excluded from the application processes and availing benefits
  - Whenever, women who had land in their names have availed support, their applications are prioritised

### Inclusion of vulnerable groups (SC/ST/Women/marginal and small farmers)

- Composition of VCRMC is representative in nature with the mandated representations from SC/ST/marginal farmers, women farmers (4-5) and women SHG member.
  - Most of the SHGs are not formed as part of POCRA.
- A total of 3821 VCRMCs have been constituted in the PoCRA project villages till now. A VCRMC consists of a total of 13 members and of the total at least 7 members are women. Out of the total 49673 members (in 3821 VCRMC), 26747 (~53%) are women members and are involved in the various decision making processes of the VCRMC.
- Women/marginalised VCRMC members' villages in most of the villages actively participated in voicing their opinion during meeting (especially sanction of applications). They also regularly followed up on the application status.
  - Women in tribal villages in the horticulture belt voiced their opinion about the need for improved varieties of horticultural crops (guava, sweet lime, watermelon and pomegranate).
  - However they expressed most of women in the village was landless and there were no specific activities/benefits targeted for marginalised women.

- A total of 69237 capacity building exercises (including training and workshops) were conducted in the project area. In these trainings and workshops around 28% of women farmer participation was seen for various activities such as NRM, soil & water conservation, livelihood entrepreneur activity, digital literacy & technology etc. Participation of women in FFS was reported to be low since they are engaged in many other household and farm activities. Across the districts lack of awareness on the FFS or the timings of the FFS is the biggest challenge faced by the women farmer for not participating in the FFS.
- The women participation was around 5% in the tribal areas of Hingoli district and 17% in the tribal areas of Nanded district (till now in the project duration).
- During the year 2021-2022, in the FFS conducted in all the districts around 23% of host are women. If we look at district wise numbers Aurangabad has the maximum percentage share of women farmer (31%) as host of the FFS. Only 15% of guest farmer in year 2021-2022 are women from all the PoCRA districts. Of all the districts, Hingoli has the least women participation (~8%) in the FFS as compared to other districts in the year 2021-2022.
- Small farmers had received training on good practices from Horticulture Department
- Of the total 1033921 unique registrations on DBT portal of farmers having land ownership around 25% applicants are women farmers having land holdings.
- Out of the total applications (1425855) received for various activities, around 18% are of the women farmer.
- Around 21% (Rs 34872.88 lakh) of the total matching grant amount has been disbursed to female farmers under PoCRA.
- Most of the beneficiaries, especially the small and marginal farmers who had received disbursement for micro-irrigation (drip/sprinkler/pipes/pumps) and horticulture plantation expressed that they have benefited from these assets. These technologies have led to water conservation and also saved their crops during less water availability in any season.
  - However, farmers who already had assured source of water supply (well/bore well) benefitted the most from these assets.
- Women also expressed that their confidence to speak in a forum (public speaking) increased after becoming VCRMC members

### **Performance of Krishi Tai**

- For better implementation of the project activities the VCRMCs have nominated around 3933 Krushi Tai's in project area who will work as female mobilizer and catalyst between village and project implementers.
- In villages, where VCRMC retained the earlier Krishi Tais are all well aware of their role and responsibilities. They acted as an interface between project team and the marginalised (marginal/small farmers/women). They are active in raising awareness about project and application procedures especially amongst women, urging women to attend meeting and motivating the community to apply and avail benefits of the programme and also mobilise women for FFS
  - They have been drawing a monthly salary of Rs 500
  - They regularly undertake home visits and pass information about the proceeding of VCRMC meeting and also explains about the application procedures
  - They have also attended training programs - community mobilisation, account maintenance, agricultural practices and FFS
- In some villages, Krishi Tai has been appointed for nearly two years, but has been remunerated for only 6 months

- Lack of remuneration is making Krishi Tai less motivated and many expressed their displeasure to continue work
- In some villages, the newly appointed Krishi Tais are not even aware of their roles and responsibilities
  - Many could not attend on-line trainings due to connectivity issues
  - In certain cases Krishi Tais are represented by her husband/male member of the family

### **Main benefits reported**

- There is no upper limit for the number of applications that can be submitted from each village, so a sense of unhealthy competition did not exist among farmers. Moreover, it was found that small and marginal farmers application were considered favourably and some of them reported increased productivity and income due to drip/sprinkler.
- The documents required and the process of application is not cumbersome and VCRMC supported them in filling the application and getting the benefit
- All beneficiaries, especially the small and marginal farmers who had received disbursement for micro-irrigation (drip/sprinkler/pipes/pumps) have benefited from these assets. These technologies have led to water conservation and also saved their crops during less water availability in any season. Around 20-35% of marginal and small women farmers are supported by drip, sprinkler, pumps and pipes at their fields.
- Farmers (small/marginal/big) have benefitted from community works like cement nala bunds and were satisfied with the quality of NRM assets
- In certain block of Nanded, sericulture was introduced by POCRA and farmers are sufficiently motivated to take up this activity.
- Hattal village is the leading guava producer in Nanded district and it was mainly attributed to the support received under POCRA and the motivation and support provided by VCRMC
- It was reported by some farmers that POCRA has ended the much needed freebie culture and changed the attitude of the community. They expressed happiness about the fact that nothing is given absolutely free of cost in this project.
- Farmers reported that the project has helped them to better understand technologies related to preparation and cultivation such as - using improved seed varieties, and rational use of fertilizers
- FFS conducted on package of practice for turmeric and soya bean was reported to be most beneficial
- Shade-net was identified as one the most important benefit from the project. This has improved the productivity of capsicum and resulted in better profit margins.
- Small and marginal farmers (62% of total 7958 members) dominate the membership in 24 FPCs surveyed.
- Around 17% of SC/ST category farmers as members and 28% female members in the 24 surveyed FPCs.
- From the 854 FPO/PPC/FIG in the project area a total of 756 women members have been benefitted for various agri-businesses activities. The project has disbursed an amount of around Rs.83.89cr to women members for agribusiness enterprises.

### **Overall challenges identified by beneficiaries**

- Most of the village, the new batch of VCRMC was yet to receive any training on role and responsibilities
  - Many could not attend on-line training conducted by POCRA team, since they did not have smart phones or faced connectivity issues

- Support for allied activities such as poultry, goat rearing and dairy were stopped abruptly from January 2020. It was a challenge for women to avail these benefits since it was meant only for landless households. Men in the households owned land and women were landless and expressed a feeling of non-inclusion of them as beneficiaries.
  - Some of the landless in tribal villages migrated to cities in search of productive employment.
- Certain saplings like Mulberry are not sold by government nurseries and often farmers procure them from local market or from other farmers where they do not get bill. This has been constraining farmers since they cannot upload bills to claim benefits from the project.
  - Sometimes good saplings are available only in district headquarters and this constrained farmers from procuring quality saplings due to high transportation costs.
- The project requires that framers can get reimbursement only after the completion of activity and submission of bills. However, an important concern raised by them is the lack of resources (cash in hand) to invest upfront in micro-irrigation systems for horticultural crops since they would already be constrained due to other expenses like land preparation, buying of saplings and labour costs among others.
  - Common demand is that 50% of the amount has to be given to farmers (especially marginal and small) having pre-sanction as advance since they cannot afford upfront contribution.
  - In some cases VCMRC connected farmers with shopkeepers that can provide them with micro-irrigation systems on goodwill that the farmer will pay the shopkeeper when they get grant from PoCRA. Although this arrangement has benefited few farmers, there have been instances where the farmers have not paid the shopkeeper promptly even after subsidy disbursements. And in some cases farmers had to even take loan from moneylenders to pay the shopkeepers.
- Another important constraint flagged by farmers is the requirement of reliable source of water to install micro-irrigation systems. While most of them had access to perennial nala (with good water flow), the farmers who did not have access demanded support for open dug well. Apparently provision for this component has been stopped now.
- Many Farmers desired to avail benefits of poly-house and shade-net, but did not have the resources to avail the benefit and hence it becomes difficult to take it up at individual level
- Mechanisation component has been stopped for more than a year and farmers appealed that it has to be resumed at the earliest
  - There is a huge demand for tractors, bullock mounted tillers, plough, individual sprayers and field implements
- Farmers are not able to mobilise institutional credit for upfront payment and they are not keen to take any credit from local money lenders. Most of the farmers also did not have any savings/cash in hand to avail benefit of the project.
  - Another problem encountered by farmers is that when they buy micro-irrigation systems from shopkeepers they get a bill which is inclusive of GST. However, the farmers lamented that they cannot claim the GST amount from the scheme.
- Mechanisation component has been stopped for more than a year and farmers appealed that it has to be resumed at the earliest.
  - There is a huge demand for tractors,
  - Farmers reported that they rent tractors and during the harvest season, the cost of renting becomes high.
- Farmers expected 100% grant or subsidy from all the government programs including POCRA. There is a reluctance to make any upfront payment and they continue to look for freebies.

- On-line training provided to Krishi Tai and others were reported to be non-effective due to challenges of having a smart phones and connectivity issues.
- A pertinent issue raised by ST/tribal farmers is that if they have availed any benefits from other schemes meant for ST/tribal welfare they are not allowed to participate in POCRA benefits.
- Participation of women in FFS was also reported to be low either due to their engagement in many other household and farm activities or due to ignorance of projects activities and benefits.
- In certain villages' sarpanch and upsarpanch positions were held by women, and they served as token representation. They exhibited lack of knowledge regarding VCRMC working and was unaware of the projects objectives and goals. Most of the decisions were taken by her husband who is regarded as functional sarpanch.

### **Suggestions given by beneficiaries/non-beneficiaries**

- Since VCRMCs members keep changing (depends on change in panchayat) frequent training/follow up refresher trainings on project guidelines and climate resilient agriculture practices has to be prioritised
  - Old VCRMC members have to extend hand holding support to newly formed VCRMC and share their experience/lessons/challenges.
- To maintain total transparency it was suggested that every GP should have a notice board which should clearly mention – eligibility to avail individual and community benefits, name of applicant, application status (pre sanction, rejection with reasons) and information about progress made in the village under the project
- VCRMC should connect farmers with shopkeepers so that they can provide micro-irrigation systems to farmers on a good-will and the farmers will pay the shopkeeper when they get grant from POCRA
- Awareness generation about the POCRA project has to be intensified since many development programs/projects are running simultaneously and people tend to get confused.
- Common demand from landless in all the villages is support for allied activities such as poultry, goat rearing and dairy and these activities was stopped abruptly in 2020. Landless, women and marginal farmers are keen to take up this activity.
- Steps have been taken to increase the availability of quality planting material by supporting the setting up of more Government nurseries/govt approved nurseries.
- Common demands include –
  - integration of solar pumps and solar fencing into the project component
  - Sericulture was identified as a potential profit making venture and training for women was requested to produce quality products
  - As most of the fruits and vegetables are perishable, there is demand for warehouse/storage facility - many a times farmers are forced to sell their produce to local vendors/middle person for a lower price
  - Support for cultivation of fodder crops and improving livestock feed
- Women sarpanch who exhibit token representation needs more motivation and hand holding to discharge their duties.
- Krishi Tai has to be remunerated on time and need more awareness and training on climate resilient agricultural practise
- Support is sought for nala deepening and widening, cement nala bunds, digging of farm ponds.

## Conclusion

Overall the analysis derived from mixed methods (qualitative and quantitative enquiry) reveal that the project has made considerable efforts in mainstreaming gender equality and social inclusion. The composition of VCRMC in all the studied villages was representative in nature with the mandated representations from SC/ST/marginal farmers, women farmers (4-5) and women SHG member and meetings were conducted once in a month. They are actively working to ensure the marginalised (including the tribal communities) are benefitted from the project through awareness generation regarding DBT system and facilitating registration and application process through portal/mobile. Older VCRMC members (including women) received capacity building training on various aspects such as roles and responsibilities, project implementation, application processes and procedures, agricultural and irrigation practices among other things. Maximum application from the marginalised has been for micro-irrigation systems (drip/sprinkler/pipes/pumps) and in most cases funds have been disbursed. All beneficiaries, especially the small and marginal farmers who had received disbursement for micro-irrigation have benefited from these assets. These technologies have led to water conservation and also saved their crops during less water availability in any season. Since there is no upper limit for the number of applications that can be submitted from each village, a sense of unhealthy competition did not exist among farmers.

Transparency is maintained and all activities/developments (pre sanction, sanction, training etc.) are communicated to the beneficiary through WhatsApp groups/Krusi Tai that was specifically created for POCRA activities. Women, especially in some of the tribal villages actively followed up on the application status and who owned lands had also received disbursement for drip and sprinklers. Women also gained confidence to speak in a forum (public speaking) increased after becoming VCRMC members.

Kurshi Tai is actively engaged in raising awareness, especially to small/marginal/women farmers about the project and application procedures through home visits, passing information about the proceeding of VCRMC meeting to the village community, motivating people to take up project benefits and mobilising women for FFS. They have undergone training for aspects related to community mobilisation, account maintenance, agricultural practices and FFS.

However, some of the challenges faced includes, non-registration of land in the name of the women which excluded them from the application processes and availing benefits. Also participation of women in FFS was low, the reason being overburdened with household and farm activities. Another observation is the token representation of women sarpanch. In some villages Krusi Tai's have neither received any training nor their monthly salary of INR 500 which prevented them from discharging their duties efficiently.

Support for allied activities such as poultry, goat rearing and dairy was stopped abruptly from January 2020 which has adversely impacted the marginalised. An important concern is the lack of resources (cash in hand) to invest upfront in micro-irrigation systems since the farmers are already constrained due to other farming related expenses. Further, small farmers/tribal communities could not avail benefits of poly house/shade net due to lack of resources. Access to institutional finance to avail project benefits remains low. ST/tribal farmers who had availed benefits from other schemes meant for ST/tribal welfare could not participate in POCRA activities.

Some of the suggestions given to further strengthen the program and process of implementation is the need for frequent training/follow up refresher trainings on project guidelines and climate resilient agriculture practices since VCRMCs members keep changing (depends on change in panchayat). Old VCRMC members have to extend hand holding support to newly formed VCRMC and share their experience/lessons/challenges.

Awareness generation about the POCRA project has to be intensified since many development programs/projects are running simultaneously and people tend to get confused. Other common demands for the community includes, integration of solar pumps into the project component, targeted training on latest technologies to improve horticulture productivity, warehouse/storage facility, solar/wire fencing, provision of cattle shed, setting up of government/govt approved nurseries and subsidy for PVC pipes (most popular type of pipe used in irrigation) among other things. There is also a demand to resume mechanisation component since there is a huge demand for tractors, bullock mounted tillers, plough, individual sprayers and field implements.

## 7. Recommendations

### 7.1 Packaging of CRATs

The MTR team analysed Climate Resilient Agricultural Technologies (CRAT) against farmers' preference/adoption as well as their significance to the project. The table 1 highlights the climate resilient technologies as per farmers' adoption.

**Table 1: Climate Resilient Agricultural Technologies as per Farmers' Adoption**

S. No.	CRAT	Characteristics	Farmer's Adoption Rate (%)		
			Baseline	Midterm	Change
1	Contour cultivation	Enhance capacity to manage water run-off and surface drainage to protect against soil erosion following high intensity precipitation.	11.1	28.15	17.05
2	BBF (Broad Bed and Furrows)	In situ water conservation practice that strengthens the farming system's capacity to cope with dry spells during rainy season	3.5	17.84	14.34
3	Micro irrigation (Sprinkler and Drip)	Helps overcome moisture stress during critical stages through supplemental irrigation. Improve water use efficiency.	34.10	46.54	12.44
4	Conservation tillage	Improve farming system's adaptive capacity to cope with moisture stress, soil and nutrient losses.	7.2	17.37	10.17
5	Improved seed (climate resilient)	Adaptation to adverse climate conditions through use of climate-smart seed varieties (short maturity duration, stress-tolerant)	31.2	40.85	9.65

The MTR team realized that the following climate resilient technologies are also significant which shall be promoted for achieving the PoCRA objectives.

**Table 2: Climate Resilient Agricultural Technologies as per Significance to PoCRA Objectives**

S. No.	CRAT	Key Resilient Feature
1	Mulching	Enhanced adaptive capacity of the farming system to cope with extreme temperature and high intensity rainfalls Improved in-situ soil moisture content. Carbon sequestration through decomposition of organic mulch.
2	Integrated Nutrient & Pest Management	Enhanced absorptive capacity of the farming system to manage pest infestations and soil nutrient deficiency induced by high levels of humidity (pests) or prolonged droughts (nutrient deficiency).
3	Agroforestry	Climate-risk management strategy to help farmer cope with adverse climate events. Crop diversification benefits (biological, financial)

4	Inter-cropping	Reduces likelihood of total crop failure due to adverse weather. Increases rainwater harvesting and optimum use of harvested water Crop diversification benefits (biological, financial).
5	Rainwater harvesting	Helps overcome moisture stress during critical stages

As the climate resilient technologies have multiplier effect when implemented together, it is recommended to package them in following categories<sup>47</sup> and encourage the farmers to adopt these technologies together. Suitable IEC materials should be developed for the farmers, highlighting the multiplier effects and cumulative benefits when following group of technologies implemented together.

The farmers should be persuaded that the selected technologies, when implemented together result in a more productive and efficient use of resources, which increase water availability and overall farm production while reducing reduce the risks associated with intra- and inter seasonal climate variability.

**(a) Climate Resilient Technologies to Enhance Water Security at Farm Level**

Rainwater Harvesting, like farm Pond (without lining); check-dam, earthen nala bund, gully plugging and de-siltation
BBF
Contour Cultivation
Micro-irrigation (drip, sprinkler)

**(b) Climate Resilient Technologies to Improve Soil Health**

Conservation Tillage
Mulching
Composting & Green Manuring

**(c) Climate Resilient Technologies to Improve Farm Productivity and Income**

Climate Resilient Varieties
Seed Treatment
INM & IPM
FFS
Inter-cropping
Agroforestry

## 7.2 Selection of Crops

The MTR team conducted assessment for the selection of crops against following criteria

1. Cost of Cultivation and C2plus50 of selected crops
2. Water Productivity of different crops
3. Availability and Productivity of Climate Resilient Varieties

**Cost of Cultivation**

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<sup>47</sup> Adapted from PAD Triple Win Solution at page 20

The MTR team conducted analysis of cost of cultivation and derived C2plus50 for main crops grown in the project area using the formula of MS Swaminathan Committee, constituted by the National Commission for Farmer. As part of the MTR survey, the average per acre cost of cultivation under the key cost heads viz. cost of inputs, cost of labour and cost of marketing (which was further broken down) was enquired from the respondents. The cost of cultivation per acre has been calculated for the key crops namely cotton, pigeon pea, soybean, black gram, green gram, chickpea and rabi sorghum. It is found that cost of irrigation is negligible for kharif crops, except for cotton which is water intensive.

Midterm	Cotton	Pigeon pea	Soybean	Blackgram	Greengram	Chickpea
<b>Sample N</b>	<b>811</b>	<b>379</b>	<b>1257</b>	<b>83</b>	<b>43</b>	<b>705</b>
<b>Key heads -Cost of Cultivation</b>						
Labour (INR/acre) - Hired and family labour	3168	2165	2468	1593	1488	1772
Bullock labour charges (INR/acre) - owned & hired	600	595	282	250	336	178
Rent of machinery (INR/acre)	1716	1933	1687	1349	1449	1500
Seeds (INR/acre)	1769	958	2267	985	661	1547
Insecticides and Pesticides (INR/acre)	2704	2139	1859	1196	1180	1434
Manures and Fertilizers (INR/acre)	3812	2128	2219	1400	1357	1529
Irrigation (INR/acre)	178	63	31	6	85	88
Miscellaneous (Transportation, Insurance, etc) (INR/acre)	986	934	1146	660	304	736
<b>Cost of Cultivation (Rs./acre)</b>	<b>14932</b>	<b>10915</b>	<b>11959</b>	<b>7438</b>	<b>6860</b>	<b>8785</b>
<b>Rental value of land (Rs./acre)**</b>	<b>5053</b>	<b>6813</b>	<b>3451</b>	<b>2110</b>	<b>1342</b>	<b>2428</b>
<b>Total Cost of Cultivation (Rs/acre)</b>	<b>19985</b>	<b>17728</b>	<b>15410</b>	<b>9548</b>	<b>8202</b>	<b>11213</b>
<b>Yield (quintal/acre)</b>	<b>5.97</b>	<b>4.52</b>	<b>5.83</b>	<b>4.05</b>	<b>2.83</b>	<b>4.82</b>
<b>C2 (Cost of Production including family labour and land rental value) (Rs./quintal)</b>	<b>3348</b>	<b>3922</b>	<b>2643</b>	<b>2357</b>	<b>2898</b>	<b>2326</b>
<b>C2 plus 50 in Project Area (Rs./quintal)</b>	<b>5021</b>	<b>5883</b>	<b>3965</b>	<b>3536</b>	<b>4348</b>	<b>3490</b>
<b>MSP Declared by Govt (2021-22)</b> ( <a href="https://farmer.gov.in/mspstatements.aspx">https://farmer.gov.in/mspstatements.aspx</a> )	<b>5726</b>	<b>6300</b>	<b>3950</b>	<b>6300</b>	<b>7275</b>	<b>5230</b>
<b>Margin to Farmers over MSP</b>	<b>705</b>	<b>417</b>	<b>-15</b>	<b>2764</b>	<b>2927</b>	<b>1740</b>
<b>Percentage</b>	<b>14</b>	<b>7</b>	<b>0</b>	<b>78</b>	<b>67</b>	<b>50</b>

MSP Declared by Govt (2021-22) (<https://pib.gov.in/PressReleasePage.aspx?PRID=1725612>)

Reference: Department of Agriculture Economics, Dr. PDKV, Akola, 2019-2020

From the above table, it is evident that the pulses namely, chickpea, Black gram, Green gram and Pigeon pea give better return to the farmers over C2plus50 as compared to Cotton and Soybean.

### Water Productivity

The MTR team also analysed water productivity of different crops which is given in table below

Crop	Water Productivity (Kg/cubic m)
<b>Black Gram</b>	0.37
<b>Cotton</b>	0.28
<b>Green Gram</b>	0.33
<b>Pigeon Pea</b>	0.26
<b>Soyabean</b>	0.52

The above table indicates that Black Gram and Green Gram have better water productivity as compared to Cotton. Soybean was found to have the highest water productivity.

### Availability and Productivity of Climate Resilient Varieties

As the project area is drought prone and crops are frequently exposed to climate shocks, availability of drought tolerant and climate resilient varieties of selected crops is critical for the farmers. The project has promoted following climate resilient varieties.

Table: Climate Resilient Varieties

S. No.	Crop	Varieties
1	Black Gram	AKU -10-1, AKU-15, TAU-1
2	Green Gram	BM-2002-1, BM-2003-2, UTKARSHA
3	Pigeon Pea	BDN -708, BDN-711, BSMR-736, ICP8863, ICPL-87119, PKV TARA, VIPULA
4	Soybean	DS-228, JS-2029, JS-335, JS9305, MACS-1188, MAUS-158, MAUS-162, MAUS-71
5	Chickpea	DIGVIJAY, JAKI 9218, PHULE VIKHRAM, RAJ VIJAY, RAJVIJAY202, RAJVIJAY-203, VIJAY, VIRAT, VISHAL
6	Sorghum	M-35-1, PKV-Kranti, SPV 1411, SPV 1595, Revati

It was found that early maturing and drought-tolerant cultivars of green gram (BM 2002-1), chickpea (BDN 708 and BDN 711) and pigeon pea provided 20-25 per cent higher yield than the indigenous cultivars in Marathwada. In the same way, drought-tolerant, early maturing cultivars of pigeon pea and sorghum introduced in Amravati district, Maharashtra provided better yield<sup>48</sup>.

It is recommended to promote Pulses (Black gram, Green gram, Pigeon pea and Chickpea) together with Soybean in the project area, while discouraging the farmers to grow cotton. Soybean cultivation should be promoted selectively while assessing the market demand and supply in different years.

It is also recommended to promote these crops in inter-cropping and agroforestry system. As inter-crops, these crops can be grown together with vegetables (chilli, onion, okra, capsicum) where water is available or with medicinal and aromatic plants like turmeric and ginger.

As agroforestry, these crops can be grown together with Papaya, Guava, Custard Apple and Citrus.

The recommendations for promoting Pulses and those crops which require less water are in line with the Govt of Maharashtra, and Government of India strategy to encourage farmers shift to larger area under these crops and adopt best technologies and farm practices, to correct demand - supply imbalance in pulses<sup>49</sup>.

### 7.3 Agro-meteorological Advisory Service

The project is recommended to provide location-specific agrometeorological advisories to the farmers.

*The meteorological advisory will include collecting, processing, and managing agro-meteorological data. The agro-advisory services will include crop specific package of practice, and technical advice on water management practices during drought, and on diseases and pest management which will aim at enhancing local capacity for community-level pest and disease surveillance.*

*The agro-met advisory services will include both as mentioned above - agro and meteorological advisory by including location and time-specific information. The agro-advisory services will be SMS/WhatsApp/mobile app and phone-in help system, where farmers can call and seek advice. The approach could be called as farming with advisories taken from the agricultural experts. It will help farmers*

<sup>48</sup> Source: <https://www.downtoearth.org.in/blog/agriculture/climate-resilient-agriculture-systems-the-way-ahead-75385>

<sup>49</sup> <https://pib.gov.in/PressReleasePage.aspx?PRID=1725612>

in reducing climate risks and enhancing crop productivity. Based on this integrated advisory support, the farmers can plan their agricultural activities by adapting to changing climatic conditions.

It is recommended that the project *work closely with agricultural universities and Indian Meteorological Department (IMD), to develop suitable IEC materials/ mobile apps to communicate with the farmers on agro meteorological information.*

## 7.4 Other Key Recommendations

### Emphasize Community NRM Work

Community NRM works under PoCRA were found to be implemented in limited numbers. On the other hand, large amounts of water are being pumped for filling the farm ponds. This is a major concern as it gives stress on the aquifer as well as groundwater. Faster extraction of groundwater for irrigation can result in aquifer depletion. During the expert visits it was observed that implementation of only individual works would not be sufficient for improving water balance and controlling the aquifer depletion.

Along with the individual benefits, community interventions for increasing the ground water level should be implemented to maintain the water balance. Micro planning and community works should be planned on priority basis. Along with them, renovation/ rejuvenation of old dysfunctional NRM structures should be promoted to maintain the water balance.

### Build Further Capacity of VCRMC Members

Limited understanding of VCRMC members on their role in planning of community work was observed during experts' visits. Refresher training and regular capacity building support should be provided to the VCRMCs to ensure that they are able to fulfil their roles and responsibilities. Capacity building of VCRMC on record maintenance and its regular monitoring should also be done. Regular monitoring and handholding support should be provided to improve record management withing the VCRMC.

### Provide Handholding Support to FPOs

Most of the FPOs which have received support from PoCRA are involved in the aggregation of agriculture produce and their marketing. Orientation and training on value addition of produce, their storage, transportation, and marketing can be provided. Handholding support should be provided to the FPOs to develop a bankable business plan so that banks would be ready to provide them loans. Facilitation support should be provided to the FPOs so that they can avail bank loan. Support from professional from civil engineering background should be provided for technical verification of civil works such as warehouse.

### Promote Financial Linkages

Financial constraints faced by small and marginal farmers in investing upfront to access project benefits remain a continuous challenge. This challenge has been further magnified due to COVID-19 as it has severely affected income of farmers. Support should be provided to beneficiaries so that they can access institutional finance. Ways should be explored by which the applicants having pre-sanction are provided partial disbursement or vouchers through which they can purchase assets from empaneled suppliers. It can be explored to develop tie ups with financial institutions so that they would provide loans to the beneficiaries based on the received pre-sanction

### Capacitate Farmers' Field School

Majority of the FFS beneficiaries reported that they have benefitted from participating in FFS. The most adopted FFS technologies include seed treatment, intercropping, use of improved seed varieties. Relatively low attendance of farmers, especially of women farmers in FFS classes is a matter of concern.

More focus needs to be given in mobilizing farmers to attend FFS session. Suitable incentives should be provided to framers to attend FFS sessions. This could include a small kit with cap, pen along with tea

arrangements and agri inputs (possible to be given). Variable timings should be attempted for male and female groups.

Exposure visits to progressive farmers plots act as a motivator for farmers to act as host farmers. Timely payment of honorarium or conveying the status of honorarium can help in keeping the rapport of the FFS and its host farmers positive amongst the farmers. More focus needs to be given on capacity building of FFS facilitators.

## **Empower Krishi Tai**

Understanding of Krishi Tai regarding the project and their roles and responsibilities were found to be low. While some Krishi Tais were aware of their roles as mobilizing women for SHG meetings, providing information about the project to farmers through home visits, motivating people to take up project benefits, and providing advice on efficient water use, majority could not articulate well on their roles.

At many places, they were not effective, either because they were not getting the honorarium on time, or they found the honorarium to be very low. To keep them motivated, it should be ensured that they get their honorarium on time. The refresher training need to be conducted for Krushi Tais so that they get clarity on the project and their roles and responsibilities. Better coordination between CAs/AAs with Krushi Tai can help in both supporting each other on their role.

## **Enhance Compliance with Environmental Safeguard**

Environmental safeguards have been integrated in PoCRA project and throughout its different components. The perception of environmental safeguards among the PoCRA stakeholders was found to be limited to the preventing felling of trees during construction of assets like laying down pipes, farm ponds, and other community works. Regarding complying with rules, mixed responses were observed.

It is recommended to conduct separate orientation and training on environmental safeguard and their compliance. Environment compliance mechanism should also be put in the place. Different ways of promoting environment friendly interventions like organic farming, controlled grazing, plantation etc. should also be promoted.

## **Promote Initiatives for Sustainability of Project Interventions**

Sustainability of project interventions is a crucial issue in PoCRA. Certain activities especially NRM related have played an important role in resource conservation and regeneration in the project villages. The field experience indicates that the farming communities are more concerned about the economic return than environment concerns. Therefore, it is recommended that the project staff should start emphasizing and sensitizing the local communities about the project sustainability, and intervention strategies should be reviewed from sustainability angle of the project interventions. The resilience matrix for the same will be prepared and submitted to PMU.

## Annexure

### Annexure 1: Methodology notes on Water Productivity by IIT-B

**Description:** This indicator measures the annual increase in water productivity at sub district level (taluka); it is expressed as a ratio of agricultural production (in kg) over evapotranspiration (in m<sup>3</sup>). It is measured from Year 3 onwards and for kharif season only. It is expressed as percentage change relative to a baseline value of 0.23 kg per cubic meter.

As per the PAD, the values are calculated based on the secondary data. The current analysis for calculations of Water Productivity has been done based on the AET calculations done by Indian Institute of Technology, Bombay. IIT Bombay being the knowledge partner of the PMU and leading research institution in the country has calculated the AET values for both rainfall as well as irrigation. For irrigation calculations, primary data from survey like geographical location, irrigation method, pump capacity, number of watering, crop type, etc. has been used.

**Methodology Used:** Farm level water productivity has been calculated using the methodology developed by IIT Bombay as follows:

$$\text{Water Productivity} = \frac{\text{Yield of crop (kg)}}{\text{Total water taken up by crop (Rainfall AET + Irrigation AET)(m}^3\text{)}}$$

1. For calculation of water productivity, farm level data related to the yield and irrigations applied has been taken based on the response from farming households during the baseline and mid-term survey. Following information related to the crop and irrigation was collected as part of the baseline and mid-term household survey for estimation of water productivity:
  - a. Crop name
  - b. Crop area in acre
  - c. Crop sowing date
  - d. Crop harvesting date
  - e. Crop yield
  - f. Number of irrigations
  - g. Type of irrigation
  - h. Flow rate of dripper system in litre per hour (lph)
  - i. Flow rate of sprinkler system in litre per hour (lph)
  - j. Spacing between installed drip in feet
  - k. Spacing between sprinkler in feet
  - l. Serial number of irrigations
  - m. Month and week of irrigation
  - n. Days per watering
  - o. Hours per watering
  - p. Depth of soil (For estimating rainfall AET)
  - q. Type of soil (For estimating rainfall AET)
  - r. Gat number of plot (For estimating rainfall AET)

2. For **sprinkler irrigation**, the flow rate was calculated using the technical specifications provided in water productivity note of IIT Bombay. Sprinkler spacing (in feet) to be converted to meter: Suppose the sprinkler nozzle spacing is 40x40 feet (around 12x12 meter), then look for this spacing in top row of Table 1. All values under this spacing denote the flow rate in mm/hr. We have selected the average or middle value under this spacing i.e., 10.2 mm/hour (marked by red circle) for computation. This method is used for selection of sprinkler flow rate.

Table 77 Technical specifications for Sprinklers<sup>50</sup>

**Technical Specifications**  
**Single Nozzle (Trajectory 25°)**  
 Precipitation rates (mm/hr) & uniformity (CU) at various spacing

Nozzle (mm)	P (Kg/cm <sup>2</sup> )	Q (lpm)	D (m)	Spacing (m)												
				12x8	12x9	12x10	12x11	12x12	13x12	14x9	14x12					
4.3	2.0	17.23	28	10.8	9.6	8.6	7.8	7.2	6.6	6.4	6.2					
	2.5	19.40	28	12.1	10.8	9.7	8.8	8.1	7.5	7.2	6.9					
	3.0	21.55	28	13.5	12.0	10.8	9.8	9.0	8.3	8.0	7.7					
	3.5	23.31	28	14.6	13.0	11.7	10.6	9.7	9.0	8.6	8.3					
	4.0	24.60	28	15.4	13.7	12.3	11.2	10.3	9.5	9.1	8.8					
4.7	2.0	20.05	26	12.5	11.1	10.0	9.1	8.4	7.7	7.4	7.2					
	2.5	22.21	26	13.9	12.3	11.1	10.1	9.3	8.5	8.2	7.9					
	3.0	24.40	28	15.3	13.6	12.2	11.1	10.2	9.4	9.0	8.7					
	3.5	26.32	28	16.5	14.6	13.2	12.0	11.0	10.1	9.7	9.4					
	4.0	27.12	26	17.0	15.1	13.6	12.3	11.3	10.4	10.0	9.7					
5.1	2.0	22.92	28	14.3	12.7	11.5	10.4	9.6	8.8	8.5	8.2					
	2.5	24.96	28	15.6	13.9	12.5	11.3	10.4	9.6	9.2	8.9					
	3.0	27.71	28	17.3	15.4	13.9	12.6	11.5	10.7	10.3	9.9					
	3.5	29.63	26	18.5	16.5	14.8	13.5	12.3	11.4	11.0	10.6					
	4.0	31.89	30	19.9	17.7	15.9	14.5	13.3	12.3	11.9	11.4					

Note:  
 - Sprinklers are tested under standard test conditions.  
 - P= Pressure, Q= Discharge, D = Diameter  
 - Colour code - Distribution uniformity

CU < 85%	CU = 85-88%	CU = 88-92%	CU > 92%
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Irrigation water in mm = (value as specified in table 1)

3. For **drip irrigation**, watering in mm was calculated by using the formulae:
  - a. Number of drippers in crop area = Crop area in acre \* 4046 (sq-m)/ Drinker spacing in feet \* 0.09 (sq-m)
  - b. Irrigation water in mm = (Number of drinker in crop area \* Drinker flow rate in lph \* Pumping hours per irrigation)/ Crop area in acre \* 4046
4. For **flood irrigation**, watering in mm was assumed to be 50.

<sup>50</sup> Source: [https://www.iains.com/PDF/Catalogue\\_2015/sprinkler/overhead\\_sprinkler/metal\\_impact\\_sprinkler/JI\\_2\\_sprinkl\\_er.pdf](https://www.iains.com/PDF/Catalogue_2015/sprinkler/overhead_sprinkler/metal_impact_sprinkler/JI_2_sprinkl_er.pdf)

The above data is shared with IIT Bombay team. IIT -B then used the farm level plug in model developed by them to calculate the AET values for each crop. The total AET included the rainfed AET and the watering AET which was calculated based on the irrigation information shared by the farmers.

## Annexure 2: Assumptions and Details for GHG Balance Estimation

### 1. Accounting Period

- The accounting period for GHG balance is 3-years of project implementation period and 14-years of capitalisation period, where project benefits continue to accrue, totalling 17 years period.

### 2. Land Use Change

- The landuse change in the project district was collected from the <http://krishi.maharashtra.gov.in/> for the period 2015-16 and 2019-20. The landuse data of 2015-16 was used as the baseline. The project area and non-project area was used to calculate the Landuse in each the project area from this dataset.

### 3. Crop Production

- The analysis for crop production was based on selecting the most sown crops (Soybean, Cotton, Pigeon pea, Green gram, Maize, Black gram, Millet, Sorghum, Groundnut, Turmeric, Onion, Chick pea and Wheat) by farmers in Kharif and Rabi season.

### 4. Livestock and Grassland

- Poultry and Goats are the major livestock found in the project area. The population is expected to increase in the project scenario by about 10,000 goats and 500 poultry. Results show that the mean per year for poultry in the project area has been around 0.8 million and for goats is around 0.4 million. Similarly in comparison to the non-project area, the mean per year for poultry is 1.3 million and goat is 1.1 million. No other interventions under management of livestock and management of grassland or grazing land have been proposed.

### 5. Inputs Investments

- *Fertilizer:* It is assumed that the current rate of consumption of chemical fertilizers would continue under the project, despite increase in the area to be brought under irrigated crops, due to adoption of IPN management practices. Results depict that in the project area there has been utilization of around 243,170 tonnes per year of urea, 970 tonnes per year of phosphorus and 525 tonnes per year of potassium respectively.
- *Electricity:* The estimates show that in the project area there has been electricity consumption of 2,600 MWh/year and for the non-project area 5,760 MWh/year respectively.
- *Diesel:* The total diesel consumption in the project area is projected to be 7283 m<sup>3</sup>/ year and similarly in the non-project area it is around 5,579 m<sup>3</sup>/ year.

### Annexure 3: Schedule of Field Visit by Experts

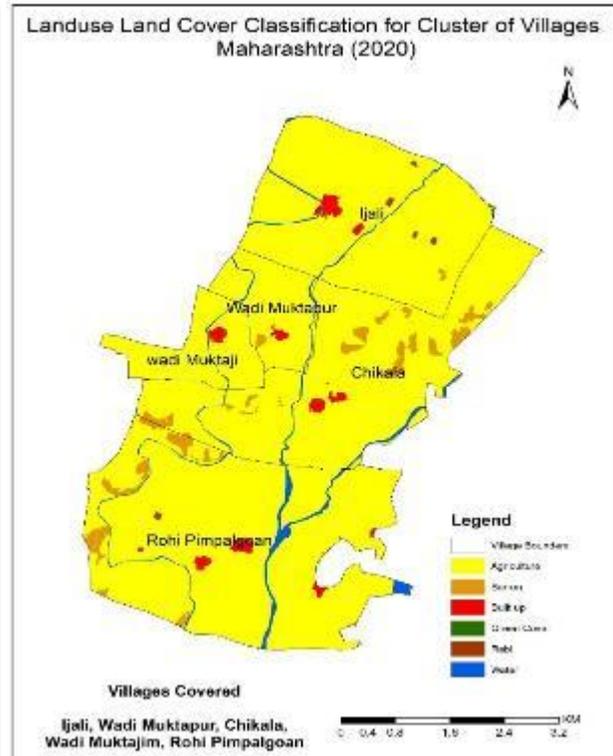
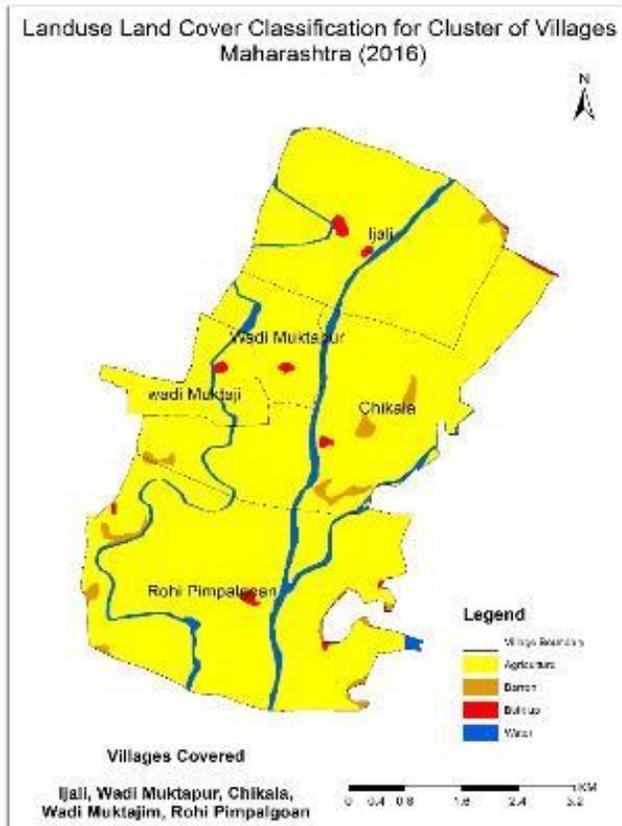
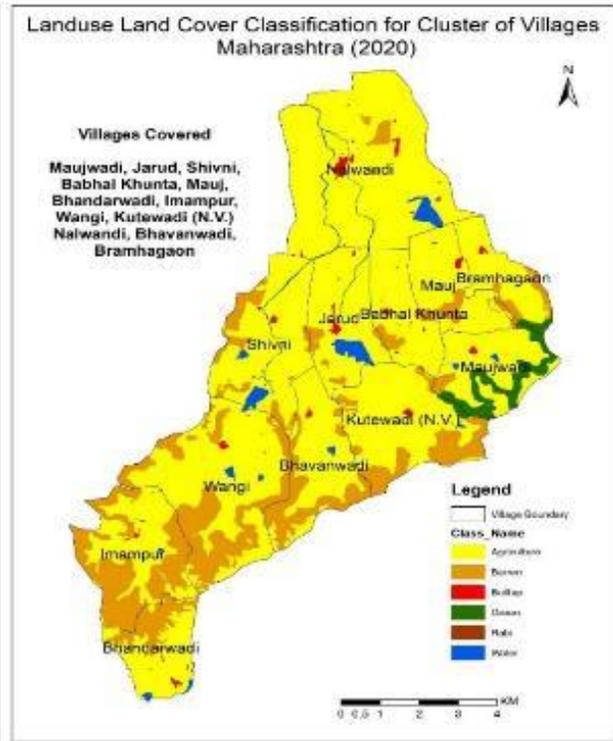
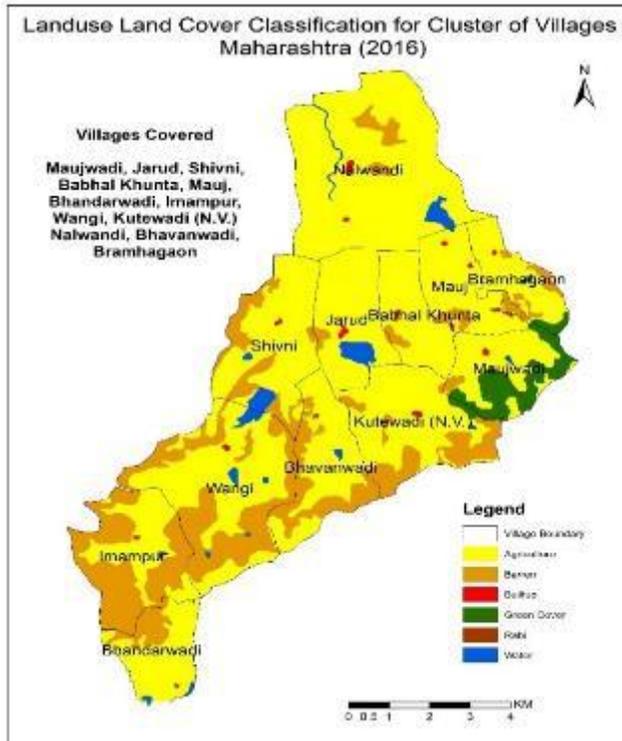
Key Expert	Designation	Districts	Blocks and villages		Date Visited
Jitendra Sinha	Team Leader	Aurangabad	Khultabad	Padali	26 <sup>th</sup> -29th December 2021
				Daregaon	
Biswaranjan Baraj	Project Coordinator	Aurangabad	Kannad	Malegaon	11 <sup>th</sup> -13th October 2021
			Aurangabad	Apatgaon	
Arindam Datta and GIS Expert	Environment Expert	Osmanabad	Aurangabad	Chitegaon	17th November 2021
			Washi	Yasawandi	
Dr. R.B Singandhupe	Agronomist Expert	Aurangabad	Aurangabad	Dukkarwadi	25th October 2021
				Gandheli	
Deodutt Singh	Agribusiness Expert	Jalna	Badnapur	Adgaon (Bk)	26th October 2021
				Tupewadi	
Mini Govindan	Sociologist	Hingoli	Aundha Nagnath	Tapowan	29th October 2021
				Bhokardam	
Dalbir Singh	Agri Economist	Aurangabad	Aurangabad	Tupewadi	30th October 2021
				Adgaon (Bk)	
Vivek Warade	Research Manager	Hingoli	Aundha Nagnath	Banegaon	1st December 2021
				Hingoli	
Vivek Warade	Research Manager	Hingoli	Aundha Nagnath	Pimpaldari Tarf nandapur	2nd December 2021
				Hingoli	
Vivek Warade	Research Manager	Hingoli	Aundha Nagnath	Sonwadi	2nd December 2021
				Hingoli	

#### Annexure 4: List of sample villages covered under the study:

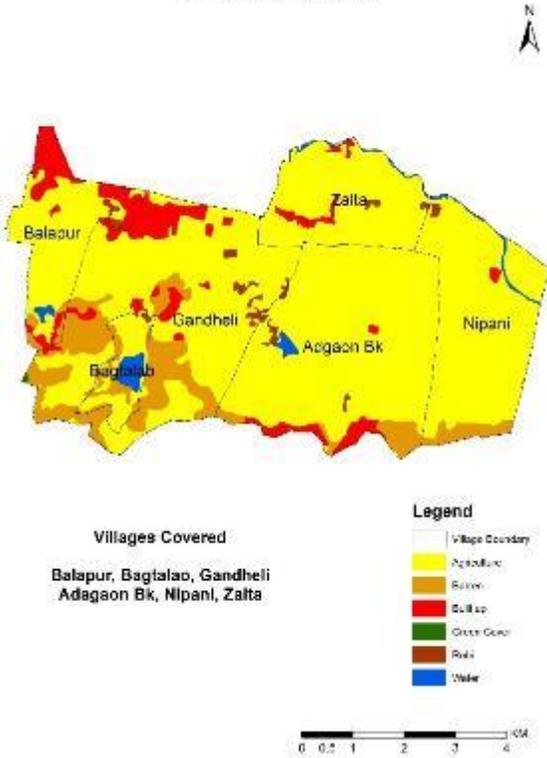
S.No.	District	Subdivision	Taluka	Census Code	Village	Cluster Code
1	Aurangabad	Aurangabad	Aurangabad	548850	Nipani	515_gp-10_04
2	Aurangabad	Aurangabad	Aurangabad	548881	Balapur	515_gp-10_04
3	Aurangabad	Aurangabad	Aurangabad	548882	Bagtalab	515_gp-10_04
4	Aurangabad	Aurangabad	Aurangabad	548851	Zalta	515_gp-10_04
5	Aurangabad	Aurangabad	Aurangabad	548883	Gandheli	515_gp-10_04
6	Aurangabad	Aurangabad	Aurangabad	548852	Adgaon Bk	515_gp-10_04
7	Hingoli	Hingoli	Sengoan	545824	Lingdari	512_gp-47_04
8	Hingoli	Hingoli	Sengoan	545836	Umardari	512_gp-47_04
9	Hingoli	Hingoli	Sengoan	545832	Jamdaya	512_gp-47_04
10	Hingoli	Hingoli	Sengoan	545833	Gondala	512_gp-47_04
11	Beed	Beed	Beed	559627	Bramhagaon	523_gv-73_01
12	Beed	Beed	Beed	559614	Bhavanwadi	523_gv-73_01
13	Beed	Beed	Beed	559654	Kutewadi (N.V.)	523_gv-73_01
14	Beed	Beed	Beed	559630	Jarud	523_gv-73_01
15	Beed	Beed	Beed	559612	Imampur	523_gv-73_01
16	Beed	Beed	Beed	559607	Shivni	523_gv-73_01
17	Beed	Beed	Beed	559661	Bhandarwadi	523_gv-73_01
18	Beed	Beed	Beed	559628	Mauj	523_gv-73_01
19	Beed	Beed	Beed	559613	Wangi	523_gv-73_01
20	Beed	Beed	Beed	559626	Nalwandi	523_gv-73_01
21	Beed	Beed	Beed	559631	Maujwadi	523_gv-73_01
22	Beed	Beed	Beed	559629	Babhal Khunta	523_gv-73_01
23	Jalna	Jalna	Jalana	547623	Kolwadi	514_gp-1a_02
24	Jalna	Partur	Mantha	548113	Bhuwan	514_gp-1a_02
25	Jalna	Jalna	Jalana	547608	Bibi	514_gp-1a_02
26	Jalna	Jalna	Jalana	547607	Sawargaon Bhagde	514_gp-1a_02
27	Jalna	Jalna	Jalana	547612	Erandwadgaon	514_gp-1a_02
28	Jalna	Partur	Mantha	548123	Shivangiri	514_gp-1a_02
29	Jalna	Partur	Mantha	548112	Wazar Sarkate	514_gp-1a_02
30	Jalna	Jalna	Jalana	547610	Kharati	514_gp-1a_02
31	Jalna	Jalna	Jalana	547611	Raigavhan	514_gp-1a_02
32	Jalna	Jalna	Jalana	547609	Pimpalwadi	514_gp-1a_02
33	Jalna	Jalna	Jalana	547613	Warkheda	514_gp-1a_02
34	Jalna	Partur	Mantha	548122	Belora	514_gp-1a_02
35	Jalna	Jalna	Jalana	547614	Sevali	514_gp-1a_02
36	Latur	Latur	Nilanga	560820	Tadmugli	524_mr-45_04
37	Latur	Latur	Nilanga	560869	Malegaon (kalyani)	524_mr-45_04
38	Latur	Latur	Nilanga	560819	Shelgi	524_mr-45_04
39	Latur	Latur	Nilanga	560812	Aurad (sha)	524_mr-45_04

S.No.	District	Subdivision	Taluka	Census Code	Village	Cluster Code
40	Nanded	Nanded	Mudkhed	544784	Wadi Muktapur	511_gv-105_04
41	Nanded	Nanded	Mudkhed	544795	Rohi Pimpalgaon	511_gv-105_04
42	Nanded	Nanded	Mudkhed	544789	Chikala	511_gv-105_04
43	Nanded	Nanded	Mudkhed	544785	Ijali	511_gv-105_04
44	Nanded	Nanded	Mudkhed	544788	Wadi Muktaji	511_gv-105_04
45	Osmanabad	Bhum	Washi	561245	Yasawandi	525_sa-25_01
46	Osmanabad	Bhum	Bhum	561204	Sukta	525_sa-25_01
47	Osmanabad	Bhum	Bhum	561205	Bhawanwadi	525_sa-25_01
48	Osmanabad	Bhum	Bhum	561203	Padoli	525_sa-25_01
49	Osmanabad	Bhum	Bhum	561206	Dukkarwadi	525_sa-25_01
50	Parbhani	Parbhani	Sonpeth	546924	Wanisangam	513_gv-83_04
51	Parbhani	Parbhani	Sonpeth	546927	Waghalgaon (j)	513_gv-83_04
52	Parbhani	Parbhani	Sonpeth	546925	Dudhgaon	513_gv-83_04
53	Parbhani	Parbhani	Sonpeth	546931	Thadi Pimpalgaon	513_gv-83_04
54	Parbhani	Parbhani	Sonpeth	546928	Lasina	513_gv-83_04
55	Parbhani	Parbhani	Sonpeth	546930	Wadi Pimpalgaon	513_gv-83_04
56	Parbhani	Parbhani	Sonpeth	546926	Vita Kh.	513_gv-83_04
57	Parbhani	Parbhani	Sonpeth	546929	Thadiukkadgaon	513_gv-83_04
58	Parbhani	Parbhani	Sonpeth	546933	Golegaon	513_gv-83_04

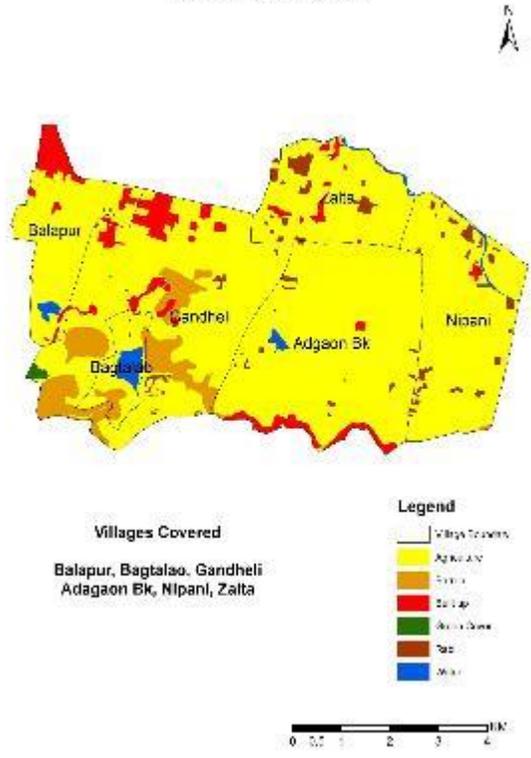
### Annexure 5: LULC GIS maps for eight clusters



Landuse Land Cover Classification for Cluster of Villages Maharashtra (2016)



Landuse Land Cover Classification for Cluster of Villages Maharashtra (2020)



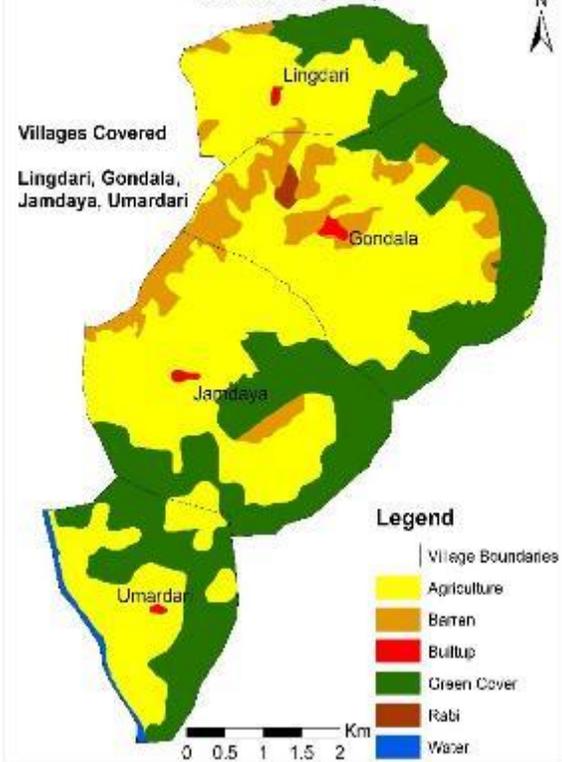
Landuse Land Cover Classification for Cluster of Villages Maharashtra (2016)



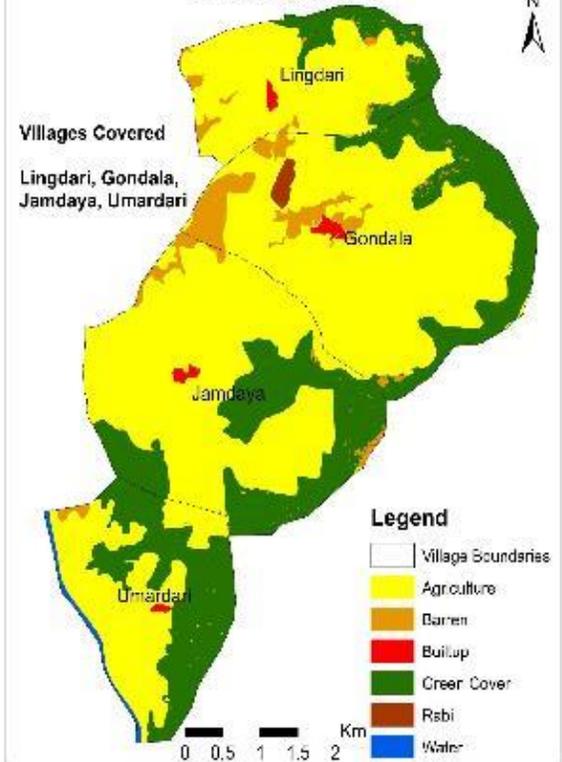
Landuse Land Cover Classification for Cluster of Villages Maharashtra (2020)



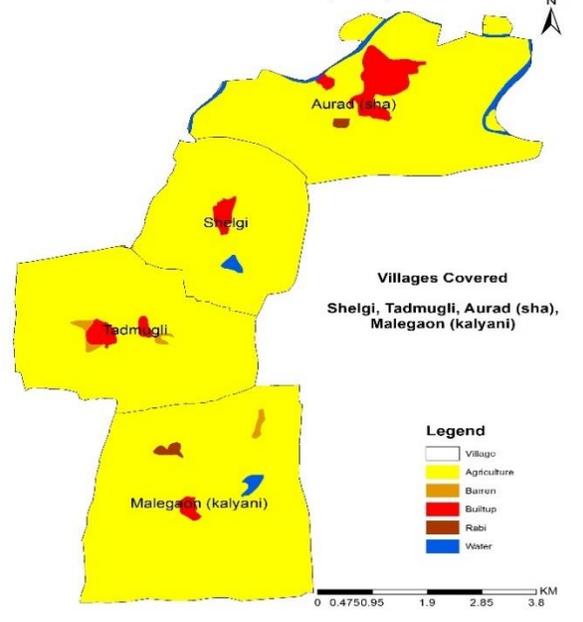
Land Use Land Cover Classification for Cluster of Villages Maharashtra (2016)



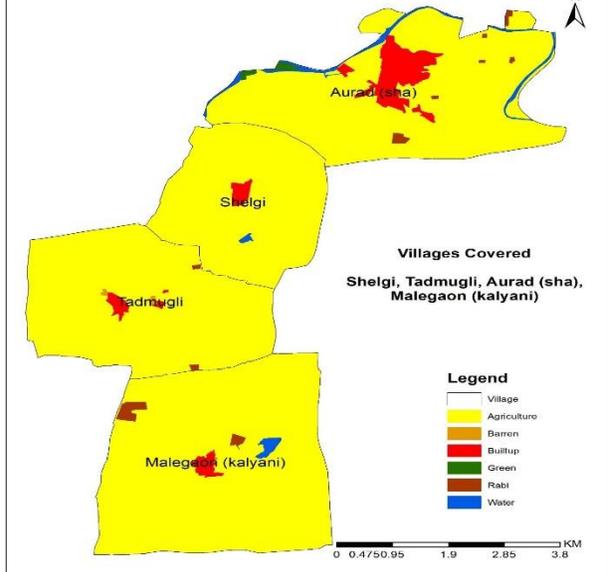
Land Use Land Cover Classification for Cluster of Villages Maharashtra (2020)



Landuse Land Cover Classification for Cluster of Villages Maharashtra (2016)



Landuse Land Cover Classification for Cluster of Villages Maharashtra (2020)





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**Sambodhi Research &  
Communications Pvt. Ltd.**

**Head Office**  
C - 126, Sector 2,  
Noida - 201301, Uttar Pradesh, India  
+91 120 4056400-99,  
+91 120 4127069

**The Energy & Resources Institute**

**Head Office**  
Darbari Seth Block,  
IHC Complex, Lodhi Road,  
New Delhi – 110 003, India  
+91-11-24682100