RESEARCH PROGRAM ON
Climate Change, Agriculture and Food Security

CGIAR

CCAFS

Village Midline Study
Karnal, Haryana State, India

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Correct citation:
Prasad S, Kargwal K, Sharma N, Jagannath P, Nagpal M, Khatri-Chhetri A. 2020. Village Midline Study: Karnal, Haryana State, India. CCAFS Report. Wageningen, the Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Available online at: www.ccafs.cgiar.org

Published by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic partnership of CGIAR and Future Earth, led by the International Center for Tropical Agriculture (CIAT). The Program is carried out with funding by CGIAR Fund Donors, Australia (ACIAR), Ireland (Irish Aid), Netherlands (Ministry of Foreign Affairs), New Zealand Ministry of Foreign Affairs & Trade; Switzerland (SDC); Thailand; The UK Government (UK Aid); USA (USAID); The European Union (EU); and with technical support from The International Fund for Agricultural Development (IFAD).

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Introduction

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) is a strategic ten-year partnership between the CGIAR and Future Earth to help the developing world overcome the threats posed by a changing climate, to achieve food security, enhance livelihoods and improve environmental management. Starting in 2011, CCAFS carried out major baseline studies at household, village and organization levels across its five target regions, namely East Africa, West Africa, South Asia, Latin America and Southeast Asia (more information about CCAFS sites is available on our website http://ccafs.cgiar.org/where-we-work). In 2018, CCAFS carried out a midline study at one of these sites (Lawra-Jirapa in Ghana) to determine if there is scope for conducting more midlines in other sites. CCAFS trained survey teams from partner organizations in each site to conduct the midlines.

The baseline effort consisted of three components–a household survey, village study, and organizational survey. The household baseline survey comported a quantitative questionnaire on basic indicators of welfare, livelihood/agriculture/natural resource management strategies, needs and use of climate and agriculture-related information and sources of information, as well as current risk management, mitigation and adaptation practices. It was implemented by CCAFS partners in 35 sites (245 villages) with nearly 5,000 households in 12 countries to date. CCAFS partners also conducted village baseline studies and organizational surveys in one out of the seven villages within which the household survey was implemented in each CCAFS site. Similar to the baseline, the midline effort also consisted of these three components with a few improvements. Data from the current midline study, as well as an endline study that will take place in roughly five years, will be used to monitor what changes have occurred since the baseline study was carried out. The goal is not to attribute changes to the program, but to be able to assess changes over time and whether these changes are helping villages adapt to, and mitigate climate change.

The focus of this site analysis report is the village midline study (VMS). The VMS aims to provide information on changes occurred since the village baseline study

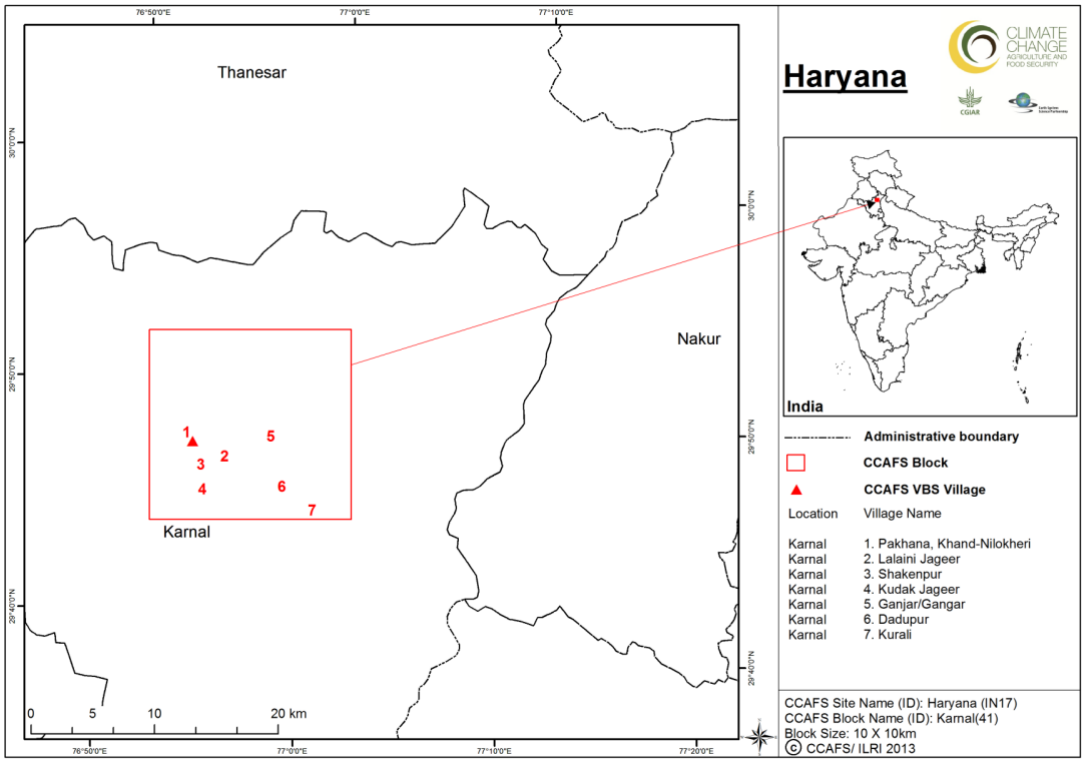
(VBS) was conducted on some basic indicators on natural resource utilization, organizational landscape, information networks for weather and agricultural related information, as well as on mitigation efforts, which can be compared across sites and with the situation at baseline.

The objectives of the village midline study are to:

- Provide an initial comparison of the situation found during the VBS to allow us to monitor changes in these villages over time. In particular, changes that allow people to:
    - Manage current climate risks,
    - Adapt to long-run climate change, and
    - Reduce/mitigate greenhouse gas emissions.
- Understand the enabling environment and changes in it, which mediate certain practices and behaviours and create constraints and opportunities (policies, institutions, infrastructure, information, and services) for communities responding to change.
- Explore social differentiation:
    - Perceptions of women and men will be gathered separately to be able to present gender differentiated perspectives.
    - Focus group participants will be selected to present perceptions of groups differentiated by age.

The detailed tools and guidelines used for the implementation of the village midline study across all CCAFS sites, as well as the manuals, data and analysis reports can be accessed on our website (http://ccafs.cgiar.org).

Map 1. Location of the Pakhana village in the CCAFS site, Karnal, India (IN1741)



This report presents the results of the Village Midline Study (VMS) conducted between 14 and 17 June 2019, in the village of Pakhana, India (Karnal site) (Map 1). Pakhana is located in the Karnal district of Haryana state and situated in the fertile flat land of India's Indo-Gangetic Plains. The village has access to roads, electricity, and communication. The Karnal district's headquarters are approximately 16 km away from Pakhana. The Pakhana location was selected for the village study following completion of a household survey at the same site and because of its relatively central location in the block.

The team was composed of two facilitators and two note takers. The team consulted the village authorities concerning the time and place of the meeting. Repeated follow-ups were done with the help of the Gurudwara to select the assembly point and invite participants. A hall belonging to the village's Sarpanch (village head) was selected for both the men's and the women's meetings.

The site coordinator sent out invitations to participants who were chosen using random sampling. Each group was composed of 15-20 participants, for both the men's group and the women's group. Three days were selected to conduct the study, with only one set of participants expected to participate in the study on each day except for the first day where the whole community was invited to participate in an introductory session. During this session, the team explained the study to them and shared the results of the village baseline study. After the opening session, the voluntary participation of 15 men and 15 women from the community was requested for the midline study. The whole community was again invited at the end of the third day to attend a debriefing session where a summary of the preliminary findings was shared.

The study used participatory methods of data collection. Throughout the data collection process, groups of male and female members of the community worked separately. On day one, each group was presented a satellite image of the village with sketches of resources that were identified by the baseline participants as being important to the community. The midline participants then identified any significant additional resources and added these to the map. The group also pointed out changes in the state of the previously identified resources. The outputs were notes, maps and sketches. The process of working with the community to determine the resources that are important to them depended entirely on their ability to understand and interpret the image and sketches.

The task on day two was to work with each group to understand the organizational landscape and existing links with regards to food security-related issues in a normal year, in a year of crisis, and in relation to natural resource management. After putting together their organizational landscape, the groups also compared it to the one that was created during the baseline study. The outputs were diagrams showing the organizational landscape. Information on each organization and their roles was also captured on cards.

Finally, there were two main tasks on day three. The first task was to work with each group to understand how information networks on weather issues and farming activities have changed since the baseline study. The outputs were diagrams. The second task was to bring the male and female groups together and discuss a vision of

what the community would like their village to be in the future. The group was then split up in two mixed groups, one assessing the progress that was made towards the vision that was created during the baseline, the other group creating a new vision. The output was a map/sketch showing "the vision of the community."

The information generated from the study were captured on photographs, maps, flip charts, information cards, and notes. All these were brought together in one debriefing report, which was shared with the villagers at the end of the day; this debriefing report formed the base of the final report. The debriefing report was prepared in the field so that it could benefit from the presence of the site team. The photographed sketches and maps were inserted in the debriefing report. In this site analysis report, proper maps and diagrams derived from the field outputs replaced them.

Data analysis

Topic 1: Community resources – participatory satellite imagery interpretation and visioning

Community infrastructure and resources as well as gender-differentiated access and use of these resources were analysed based on a process of participatory visual interpretation of high-resolution satellite imagery. The aim was to examine how community resources and community dynamics about the environment have changed since the baseline study, which was conducted in March 2013. The participants were presented with the maps created by the baseline participants and discussed any changes in the state of those resources in terms of quality, access, and management. They also reflected on potential drivers of change. Later on, when both non-mixed groups were joined together and formed two new mixed groups, participants in the first mixed group developed an image of village resources and human well-being into 2030 while participants in the second group assessed the progress made towards the future vision that was created by the baseline participants. The detailed approach to this exercise is outlined in the CCAFS Village Midline Study Implementation Manual.

A. Changes in natural resources

There were two separate meetings in Pakhana, one with men and the other with women. Participants first considered the satellite image of the village extracted from Google Earth and reflected on changes in natural resources and infrastructure over the last six years. Both groups were able to identify multiple community resources in the satellite image. Moreover, both groups were able to identify changes and various new elements were added to the map.

Male and female participants provided the following information on changes in their community's resources, including infrastructure (Table 1 and 2, Map 2 and 3).

Photo 1. Community members participating in the exercise on natural resources and infrastructure

Map 2. Major changes in resources (compared to baseline) according to the men's group

Map 3. Major changes in resources (compared to baseline) according to the women's group

Table 1. Major changes in natural resources since the baseline study (2013), as perceived by men (M) and women (F)

Land cover class	Community determined land use	Location names	Has there been a change since baseline? Yes/No	Description of the change	Reason for change	Agents of change
Gurudwara (M, F)	The place for religious and social gathering, communication, social and development purposes	Main road, Sounkra road	No			
Temples (M, F)	Place for religious and social gathering	Multiple locations (Dayalpura and Pakhana)	No			
Ponds (M, F)	Used as a discharge for wastewater	Two ponds within the village	Yes	The ponds now have a well-connected pipeline system which allows for a managed drainage of the sewage	Development activities	Gram Panchayat
Canal (M, F)	Water for irrigation	2-2.5kms away from the village	Yes	The canal now only supplies water for two months	Climate change. There is very little rainfall, and the canal is dried up.	Rainfall
Borewells (M)	Used for irrigation	More than 500	Yes	The number of borewells has increased, and their depth has also increased.	Increase in demand for irrigation due to market-led agriculture. The development of market led agriculture is linked to the assured market (including export) for Basmati rice that receives high price.	Farmers have access to subsidized electricity for pumping groundwater for irrigation.
Water tank	Used as the primary source of water in the	Main road near the	Yes	It has improved the water supply system and increase the	Development activities	Gram

(M,F)	village	Gurudwara		capacity.		Panchayat
Farmlands (M, F)	Agricultural production	Multiple locations	No			
Cremation grounds (M, F)	Last rites of the dead	2 in the village	Yes	They have been upgraded and have sheds and gates		Gram Panchayat
Roads (M, F)	Transportation	In and around Pakhana	Yes	Better connected road network	Development activities	Gram Panchayat
Schools (M, F)	Provide education to children	Two government (primary and secondary) along with a private one in the village	No			

Table 2. New elements added to the map

Land cover class	Community determined land use	Location Names	Current state (quality)	Time to resource	Management and ownership issues	Opportunities	Limitations
Gram Panchayat Bhawan (M)	Used for social gatherings and dispute settlements.	Main road near the Gurudwara	Ruined/ dilapidated	2 minutes	No funds for the repair of the building	Government funding	The office is run at the Sarpanch's house. This can pose an access problem for some people.

Veterinary Dispensary (M)	The only veterinary dispensary in the village	Main road near the Gurudwara	The veterinary dispensary is in good condition however, the villagers prefer services of private practitioners during emergencies	Within the village	Government	The veterinary dispensary is located at the central point of the village and is hence accessible to all villagers. The location also facilitates services access for the villagers. It provides free vaccination and Artificial Insemination services to the villagers in addition to curative services. The highly commercial dairy activity benefits from it	The operating hours of the dispensary are limited, it cannot provide emergency services for the villagers.
Anganwadi (M, F)	Pre-primary education	4 in the village	Good. It should be noted, however, that prosperous households do not send their children to Anganwadi, they are sent to play schools nearby	Within the village	Enrollment of children and nutrition supplement is only available to pre and post-natal women belonging to poorer families		Low enrolment

Rice mills (M, F)	Use to process rice f	In and around Pakhana(15-20)	Increasing in number	5 minutes		The guaranteed market for paddy	Decreases the groundwater quality as it directly disposes of the wastewater without treatment directly into the aquifer.
Road network (M, F)	Transportation	In and around Pakhana	Good			Better market access	
Resorts(F)	Social gathering and parties	Main road	Good	10 minutes			

The group meeting consisted of people belonging to various backgrounds and age groups. However, as the village is very prosperous, the men's group was mostly composed of wealthier inhabitants whereas the women's group was more mixed. Men and women provided the following information regarding the community's natural resources and infrastructure.

Gurudwara: At the entry point of the village, there is a Gurudwara which is a revered place for Sikhs as well as for Hindus. It serves as a place of worship, but also for social gatherings and dispute settlements. The place also provides information to the villagers with its public announcement system. The Gurudwara provides a free meal service for all, which is god's food and known as *Langar*. The place is important and respected among the residents of the village.

Similarly, there are two Hindu temples in the vicinity of the village. They fulfil a religious and worship function for local people.

Forest: There are few trees planted in the field and on the roadside as well as along the canal, however, there is no natural forest in the area. The baseline study had pointed out that there used to be large tracts of forest in the past. Many of the trees were cut to make way for immigration from western Punjab (i.e., Pakistan). The tree cover was destroyed gradually and especially after the 1960s' Green Revolution in which most of the forest was destroyed and converted to farmland. The forest used to provide fuelwood, timber and other various products for the villagers. As the tree cover has significantly reduced, the workload of the Forest Department has declined.

Water: The important monsoon crop of Karnal, i.e., rice, needs four to six times irrigation in the absence of assured rainfall, which is noted to remain erratic and low. However, the Green Revolution in the semi-arid region has brought prosperity among the farmers who have heavily exploited natural resources. In Pakhana village alone, the groundwater has gone down 85 feet BGL as reported in 2019. These compelled farmers to change the engine power of their pump set from 5 HP to 15 HP or in some cases 20 HP. For irrigation, high powered pump sets are used 24/7 for about 60 days to cultivate Basmati rice. As the season is restrictive, the farmers do not wait for the rains to arrive in case of delayed monsoon. As the transplanting requires inundation of the field, groundwater is used to submerge the plot. Significant issues related to access

to land along with the lack of groundwater recharge and over-exploitation of the aquifers are concerns which were raised during the study.

The Satlej canal system, which is used to provide water to the village and farmlands now only gets rainwater during the monsoon. A large government irrigation canal (on the south and west of the village) passes through the village, but farmers have no access to it. The community have two ponds, but they are not usable except for animals and are drying out. They are also used for wastewater disposal.

There is a well-connected pipeline network used for drainage of the sewage. This pipeline is further connected to Sheikhanpura.

Farming: Basmati rice and wheat, which are the main crops of the area are cultivated commercially and sold at nearby Mandis, such as the one located at Taraori. A portion of the food crops is retained for home consumption. Moreover, there are about 15 to 20 rice mills near Pakhana village. Pakhana is a highly developed agricultural village with very high productivity in both agricultural and livestock production. There are several agro-related plants to add value to raw food crops.

The area is highly mechanized. The historic abundance of cheap labour from the eastern Indian states has waned over the years, which has compelled farmers to mechanize operations. However, there is still a preference to do transplanting by manual labour rather than using mechanized solutions. Yet, from land preparation to harvesting and primary processing (dehusking, deseeding among others), machinery is used. Chemical inputs are also widely used in the village. Some farmers have recently experimented with organic farming; however, they have apprehensions regarding lower yields. Nevertheless, the crops produced organically reach a premium price in the local market following growing health consciousness among villagers.

Among the crops that are not being cultivated any longer are pulses, sugarcane, and millets. A majority of the households have stopped growing tomatoes, as was reported in the baseline. The primary reason behind this is the inability to fetch a reasonable market price for tomatoes.

Livestock: Almost all the households rear milch cow and buffaloes. As most of the households own large animals, fodder is grown apart from the by-products (husk and

straw among others) of the wheat, and paddy is fed to the animals. The milk is sold commercially, and some is used for own consumption. For feeding the livestock, fodder crops like clover, sorghum, maize, and berseem are cultivated. Livestock's manure is applied in agricultural fields. However, there are existing possibilities to fast track the process of composting by using vermicompost and NADEP composting methods.

During the midline study, it was found that the practice of rearing small livestock has decreased. When probed, the participants reflected that there is a lack of grazing land and rearing a small herd is no longer remunerative due to associated labour cost.

Land: The land is fertile and flat, with most of the farmers owning more than one hectare of land. There are few community lands. Chemical fertilizers and pesticides are increasingly used with leads to declines in soil fertility in the area.

Roads: Pakhana has good road access which facilitates the transportation of agricultural inputs and products between the village and the markets. The village has an internal road system and is also connected to a national highway, i.e. to New Delhi, Chandigarh, and Karnal. The sale of agricultural products is not a problem for farmers in this area. Big trucks are used for the transport of produce to the local markets during the harvesting season.

Health: Basic health facilities are not present in Pakhana, however, modern facilities are available nearby in Taraori, Karnal, Chandigarh, and New Delhi.

Schools: There is a government-run primary school, a secondary school and a private Saraswati Vidya Mandir. The villagers want the school to be upgraded so that higher education will be available to the students within the village, which is especially essential for female students. Moreover, there are four Anganwadi centres in the village. Because of the high economic status of most of the villagers, private schools are usually preferred. However, there remains an aspiration to improve the current facilities. The Anganwadi centres are important for the poor and marginalized inhabitants as the prosperous households are opting for Play Schools or Saraswati Vidya Mandir because they consider the facility to be sub-standard. The Anganwadi centres serve the landless and marginalized sections of the village. They are especially

instrumental in providing nutrition, vaccination, and preschool education for children below the age of 6 years.

Cremation grounds: There are two cremation grounds in the village belonging to different communities and now being upgraded by the Gram Panchayat. They have a new gate for entrances, proper water facility and sheds. These changes were noted to have occurred since the time the baseline study was conducted.

Gram Panchayat Bhawan: The main hall belonging to the Gram Panchayat, which is used for social gatherings, community meetings, and dispute settlements among others, is now in ruins.

The villagers also mentioned the increasing number of rice mills in the village, which presents both benefits and disadvantages. The presence of rice mills provides a guaranteed market for rice crops, which has also led to an increase in land prices. Moreover, the rice mills produce a large amount of wastewater which is directly disposed of without treatment into the aquifer. This leads to a decrease in groundwater quality. As mentioned by the Sarpanch, it has led to an increase in the total dissolved solids (TDS) in the groundwater, which has led to the necessary installation of Reverse Osmosis (RO) Purifier in most of the households. The Sarpanch has already written about it to the Pollution Control Board to push for essential treatment of the wastewater before disposal.

B. Gender-differentiated comparison of changes in conditions

The VMS conducted non-mixed meetings with a men-only group and a women-only group. As per Table 1 and 2, the views of male and female participants regarding the community resources were generally similar except when it comes to the borewells, veterinary dispensary, and the Gram Panchayat Bhawan, which were only mentioned by the men's group.

As presented in the tables, men and women participants had similar views on the changes in the condition of community resources. The men and women's groups both noted the same community resources such as Schools, Anganwadi, Ponds, Canal, Gurudwara, etc. Men provided more detailed knowledge on changes and impacts on the community. For example, the increasing number of bore wells in the village were

noted by the men's group only. This can be attributed to the fact that women do not usually work in the fields. Women working in the fields, who are from the poorer and marginalized sections of the community, are regular wage labourers. They are consequently less concerned about the irrigation source and related issues.

Both the men's and women's groups pointed out the increasing number of rice mills in and around Pakhana. The men's group also noted that rice mills have a considerable impact on the groundwater quality of the village. This is because rice mills dispose of the wastewater from industrial activities directly into the aquifer, thus polluting the groundwater.

Both groups mentioned the drainage network through the pipeline system connected to the ponds and the existence of a new proper drainage system in the village. Women further highlighted their concerns regarding the solid waste disposal as the village lacks a proper waste disposal site.

Map 4. Overlay of changes in conditions, comparing the men's and women's maps

C. Eye comparison of a new satellite image with baseline satellite image

The men's group was able to identify changes in the present satellite image from the baseline satellite image.

The men's group was more comfortable with this activity than the women's group and identified various changes in the landscape that have occurred since the baseline study. The primary ones were related to the development activities in and around the village. For example, they mentioned that the village now possesses a better road network and a well-connected pipeline system which ensures proper disposal of sewage water. The water tank enables the supply of water to every household in the village.

As mentioned by in the women's group, changes in natural resources noted since the baseline included decreased water levels and the canal remaining dry in offseason. The farmlands are unchanged with rice rills installed in the surrounding area. Many development activities were being carried out in the village by the Gram Panchayat. Finally, the women's group also mentioned that many new resorts have come up around the village.

The tables below show the various changes observed by the villagers while comparing the midline (present) satellite image to that of the baseline (past) satellite image with the reasons given for various changes.

Table 3. Changes observed when comparing the satellite images (men)

Main changes observed	Reasons for the change
The village now has a better road network.	The Public Works Department has constructed a road of good quality joining Pakhana from Taraori to Sounkra.
Sewage disposal for the village	The village now has a well-connected pipeline system which ensures proper disposal of sewage water.
Improved water supply system	The overhead water tank near the Gurudwara enables water supply to every household in the village.
The groundwater quality has degraded due to wastewater of rice mills	Due to the increased number of rice mills in and around Pakhana. The mills directly dispose of the wastewater without treatment. Some villagers reported high TDS and heavy metals presence in the water.
Increase in number of bore wells	The government policy of providing free electricity for agriculture has given rise to mindless exploitation of groundwater but the recharge of groundwater is not following. There are around 500 such borewells in Pakhana.

Table 4. Changes observed when comparing the satellite images (women)

Main changes observed	Reasons for the change
The village now has a better road network	A newly paved road has been laid, increasing the access for villagers to markets and services
Increase in the number of rice mills	In 2013 when the baseline was done, there were only eight rice mills in the vicinity of Pakhana. This number has increased to about 20 near Pakhana,
Dried canal	The canal only provides water during the rainy season for two to three months.

D. Progress towards a vision of the future as created during the baseline study

During the baseline study, a group composed of both men and women created a vision for 2030. The various opportunities and constraints attached to it were also considered. To achieve the 2030 vision as created during the baseline study, much of the support came from the Gram Panchayat which promoted many development activities within the village. However, a lack of space and funding have hindered the progress towards the vision. These development activities included a pipeline network for drainage of wastewater, better road network and improved condition of the cremation grounds. These were all done by the current Sarpanch, who happens to be a farmer by profession. He along with other prosperous farmers are promoting organic farming and sustainable use of farmlands.

The sewing centre envisioned during the baseline that was supposed to provide vocational employment for women has not yet started. The Gram Panchayat Bhawan (Gram Panchayat Building) itself is in a state of ruins and is no longer used.

Many of the girls are forced to drop out of school because the school only has classes up to the 8th standard. It was envisioned that if it classes up to higher secondary (up to 12th) can be provided, then girls would be able to continue their education since education would be accessible close by. However, the government has not sanctioned funds or allocated adequate staff for class 12th. The improved road condition and connectivity is now enabling children to access higher education at nearby areas including Taraori, Nilokheri, and Karnal but the distance is limiting access for girls.

Similarly, the village does not have a health centre and is dependent on nearby towns. Improved access is a reason given for not setting up a hospital in Pakhana. However,

with an increased number of industries being set up, The Employees State Insurance Company should set up a hospital for factory workers and their dependents, which can also benefit the local Pakhana people.

Contrary to the vision of the baseline, the number of factories has increased instead of going down and are situated near the village. Pollution has also increased.

The quality of farmlands is improving for progressive farmers, who are now aware that soil quality degrades with overuse of chemicals. Farmers have also been adopting improved techniques to reduce input use and maximize profits.

E. New vision of the future

The activity about the new vision for 2030 was done with a mixed group during the midline study as well. Men and women together discussed their vision. They talked about better internet connectivity, better electricity supply, and better prices for farm produces. Concerns were expressed regarding decreasing groundwater and increased pollution. Participants reflected their awareness of this by noting that TDS in groundwater has gone up to 800 ppm[1]. Participants would be happy if actions are taken to recharge groundwater and to curb pollution. An initiative by the Gram Panchayat to write to the Central Pollution Control Board is an indication of that. Similarly, they expect the government to do something to control the growing menace of stray cattle and *Nilgai*. The isolated efforts to try organic farming by some farmers is another pointer to the kind of vision they have surrounding the food they consume as they reflected on the better taste of crops grown with organic manure. Participants also expressed their vision concerning education in the village and their wish to have a higher secondary level school and a college within the vicinity. They also talked about solid waste management and suggested that the village should have proper waste disposal site and dustbins placed as common places in and around the village. They also reported the lack of health centres in the village and expressed their wish to have one in the village. The main health centre currently is in Sounkra which is about 4 km away and serves the entire Gram Panchayat.

[1]Parts per million

Map 5. Future map of the community

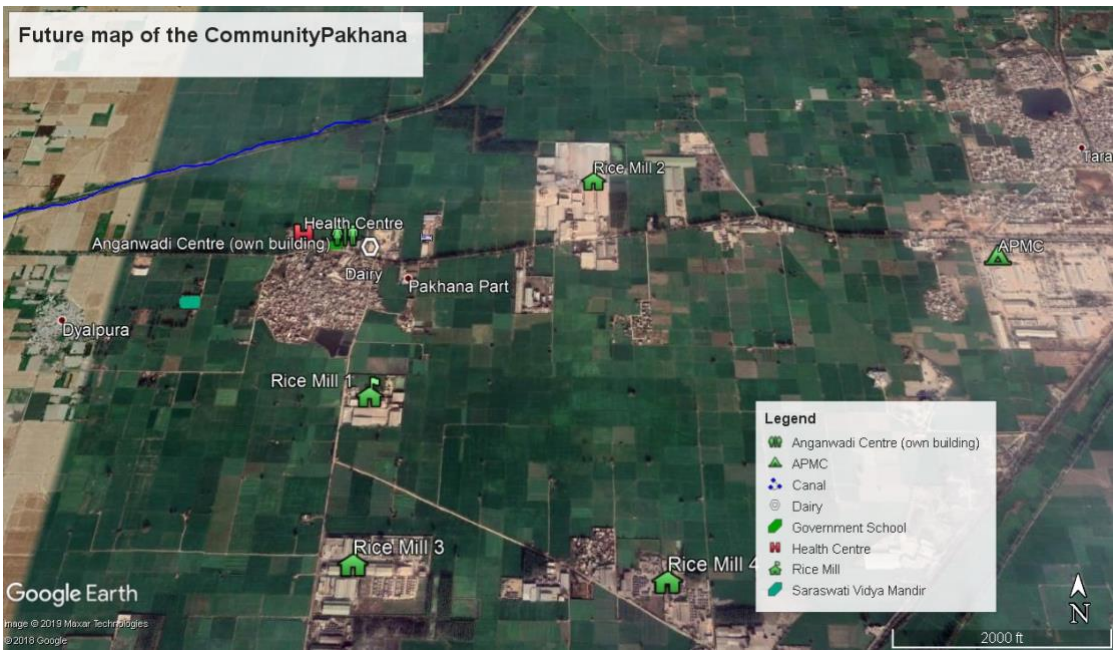


Table 5. Update about the vision of the future that was created by the baseline study group (2011)

Feature or resource discussed during the baseline study	Describe any progress in moving toward achieving this goal	What has helped in making progress (if any)	What has hindered progress (if any)	Who has helped and how
Sewing centre	No	-	Lack of space and funds	-
School	No	-	Lack of funds	-
Hospital	No	-	Lack of space and funds	-
Factory	No	-	Prosperous agriculture and higher productivity provide raw materials at a cheaper rate along with reduced transportation cost. The number of factories in the area has thus doubled.	
Library	No	-	Lack of funds	-
Farmlands	Farmlands are maintained	Awareness of organic farming is growing among farmers. Higher amounts of organic manure are used which helps retaining soil quality	-	KVK and organic input companies
Stadium	No	-	Lack of funds	-
Canal	No	-	Erratic rainfall	-
Roads	Yes, roads are now improved	Public Works Department (PWD) has constructed the new road and inside the village, Gram Panchayat has paved the streets near habitations	-	PWD and Gram Panchayat
Railways	No	-	-	-
Drainage	Yes, the village now has a proper drainage system	Initiatives of the villagers and the Gram Panchayat leadership	-	Gram Panchayat
Cremation grounds	Yes, sheds are built	Initiatives of the villagers and the Gram Panchayat leadership	-	Gram Panchayat

Table 6. New vision of the future

Feature or resource discussed	Preferred condition for 2030	Opportunities	Constraints	Organizations to be involved
School	Present school should be further upgraded to include a higher secondary school which would be more convenient for girls	It would be more suitable for girls as they will not have to travel much.	-	State Government
Farming	A shift towards organic farming for healthy and nutritious food. This would improve health condition and reduce the cost of production	It would lead to healthier farming production	Organic farming comes with a decrease in output per acre	Government, Research Institutes
Rice mills	Rice mills should have proper and regulated disposal for wastewater	It would restrict mills' usage.	-	Pollution Control Board
Ensured Market	Guaranteed market for all types of food grains (especially Maize)	Shift from paddy to maize	Lack of guaranteed market for maize currently	Government, Mandi
Dairy	Dairy cooperatives for milk collection within the village	The milk collection would ensure the appropriate price for milk. It will reduce the cost of transportation and provide guaranteed and regular income	Lack of funds	Haryana Dairy Development Cooperative Federation Limited (VITA)
Abandoned stray cattle	Should have a protective shelter for abandoned cattle (Goshala)	It would reduce crop losses due to animals stepping on plots while providing the animals with a comfortable environment	Lack of funds	-Gram Panchayat, Animal Husbandry Department, NGOs
Canal	The Satlej canal should be connected to river Indri	Water would be available for irrigation	-	Department of Irrigation, Government of Haryana
Job cards	Job cards to be provided to everybody under Mahatma Gandhi National Employment Guarantee Scheme (MGNREGS)	Employment	Many of the landowners would not do unskilled labour for the daily wage they are provided with	Government through the Gram Panchayat

Anganwadi	Shift from the rented centre to a permanent one	-	Lack of space	Gram Panchayat
Waste management	The village should have proper waste disposal site and dustbins	Waste site disposal	Lack of space and enforcement	Gram Panchayat
Hospital	The village should have a health centre	Health care would be readily available to the community.	Lack of space, funds	Government

Topic 2: Organizational landscapes

This section summarizes the existing organizational capacities that help address food security and resources management issues. This will inform CCAFS about the level of preparedness of the village and its capacities to respond to the challenges envisaged as a consequence of climate change or other future challenges. Learnings will enable engagement with CCAFS partners at a collective level.

Specifically, this section presents the main formal and informal organizations involved in the community in general, but also especially in food security and natural resources management (NRM) related issues. It also elaborates on what types of activities the organizations are engaged in, who their members are, whether the organizations are seen as useful, etc.

A. Basic spheres of operation

Participants were asked to draw three large concentric circles on the ground. The inner-circle would represent the community, the middle circles the locality and the outer circle beyond the locality. Participants were then asked to name organizations working in the area, whose names were written on cards, and subsequently placed on the appropriate circle. Consequently, the groups placed the cards of organizations that worked in the community in the inner circle, circle the cards of organizations operating in the locality in the middle, and finally, on the name of organizations that operated beyond the locality in the outer circle. Photo 2 shows an example of the activity carried out by the study's participants. The results are shown in the diagrams that follow.

Following this structure, the men's group identified ten organizations in the village while the women's groups identified eight organizations. Eight of the identified organizations were pointed out by both the men's and women's group. The majority of the organizations identified were operating within the community. In Tables 4 and 5, more detailed information is provided on the five most essential organizations as ranked by the men's and women's groups.

Photo 2. The organizational landscape activity in progress

The participants talked about the different institutions that are meaningful to them and ranked those in terms of utility. Prominent among the organizations listed were: the school (up to class 8th), the Gurudwara, the Anganwadi centres, the Gram Panchayat, the Veterinary centre (even if they rely more on private practitioners owing to the large livestock population of the area), the Agriculture department, Mandi, rice mills etc.

They listed the school as one of the top organization because it provides education to children. There are two schools in the vicinity, one is government-led and the other one is private.

They also ranked the Anganwadi centres high because they provide food, especially to the poorer families, as well as providing health and vaccination support. The Anganwadi centres also support pregnant mothers and small children as well as teenage girls. They also serve as a preschool for children below the age of six years.

Moreover, the Gram Panchayat works actively in the village and manages various development activities in the village. The drinking water supply system is maintained by the Gram Panchayat, with has another head water tank near the Gurudwara which supplies water to every household in the village.

The Gram Panchayat has also been listed in the women's group because some of the participants were wage earners and for them, who are dependent on MGNREGS, the Gram Panchayat plays an essential role as they get work within the village. Most of the work centred on clearing the dirt in the two main and ecologically sensitive ponds in the village. Participants pointed out that the animals rest there during the summer period to get respite from the heat. The ponds are cleared occasionally or seasonally which generated wages for the poor.

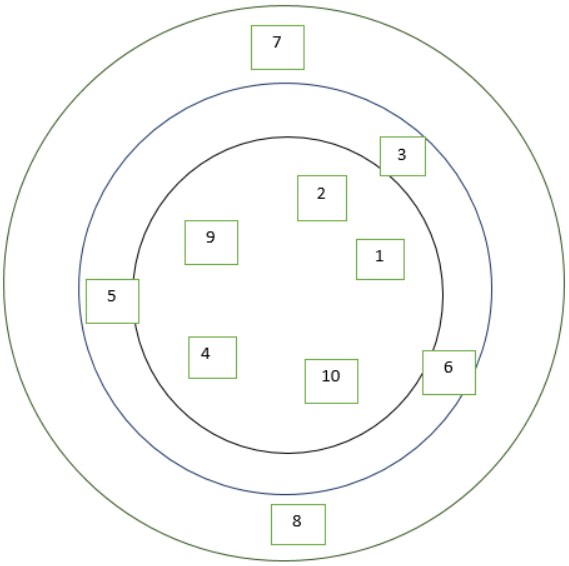
The bank also plays an essential role as it belongs to a co-operative society which provides loans to the members of the society. Farmers get benefits from the Primary Agricultural Credit Cooperative Society (PACS), which is directly linked to the bank.

The Department of Agriculture through the Block Agriculture Office provides farm inputs such as seeds, fertilisers and subsidies to the farmers. They also promote cash crops and high yielding variety of crops. Many training programmes are also facilitated by government offices, which helps in creating awareness of new farming techniques.

The Agricultural Produce Market Committee/ Mandi is also seen as an important organization for participants as it guarantees the market for crops products and allows farmers to sell their products at stable rates fixed by the government.

There were many linkages among the different organizations in the region. The Gram Panchayat was found to have linkages with the Anganwadi centres, Public Distribution System (PDS) Shop, Electricity Department, and School. The District Agriculture office in Karnal also has linkages with the Block Agriculture Office in Nilokheri and the Agriculture Science Centre (Krishi Vigyan Kendra, i.e., KVK) in Uchani. Similarly, the District Animal Husbandry Office in Karnal also supports the Livestock centre of Pakhana village.

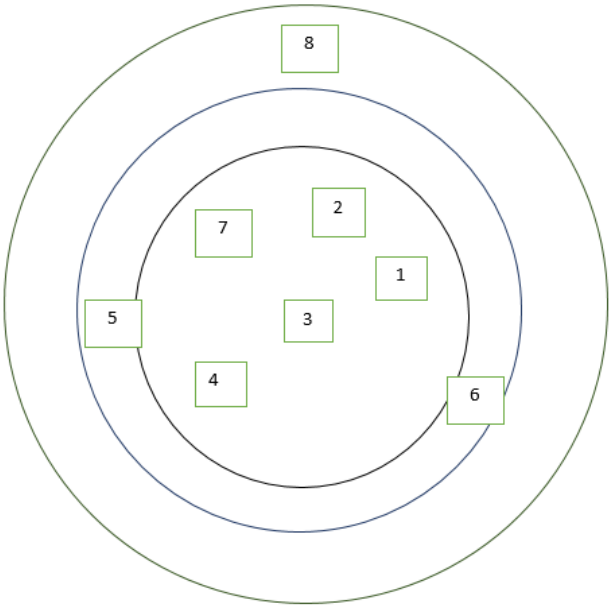
Figure 1. Organizational landscape according to the men's group



Legend

1	School
2	Aanganwari
3	Agri Produce Market Committee
4	Panchayat
5	Bank
6	Electricity Department
7	Block Office
8	District Agricultural Office
9	District Animal Husbandry Office
10	PDS

Figure 2. Organizational landscape according to the women's group



Legend

1	Aanganwari
2	School
3	PDS
4	Panchayat
5	Bank
6	Agri Produce Market Committee
7	District Animal Husbandry Office
8	District Agricultural Office

Table 7. Information on the first five organizations ranked by the men

	Organization name	Main activities	Number of members (estimate)	Access (open or restricted)	Origin (indigenous, state, NGO, project)	Sphere of operation: community, local, beyond local	Sources of funding (members, external, both)	Existed how long (less than 1 yr, 1-5, longer)	Formal or informal
1	School	Provides education to children and mid-day meal	Whole community (Students)	Open	State	Community	External	Longer	Formal
2	Anganwadi	Provides food, vaccination, and medicine to children up to 6 years of age. Also supports pregnant and lactating women. Acts as a preparatory school	Children up to 6 years of age, pregnant and lactating women	Open	State	Community	External	Longer	Formal
3	Agricultural Produce Market Committee (APMC, Mandi)	Buys the farm outputs from the farmers at fixed prices (minimum Support Price)	Whole community	Open	State	Local	External	Longer	Formal
4	Gram Panchayat	Local governing body which resolves local issues and, if required, passes them on to the block and district offices. Facilitates all the development activities as well.	Whole community	Open	State	Community	External	Longer	Formal
5	Bank	Provide loans to farmers. Offering Kisan credit cards and facilitating insurance schemes	Most of the community	Open	State	Local	Both	Longer	Formal

Table 8. Information on the first five organizations ranked by the women

	Organization name	Main activities	Number of members (estimate)	Access (open or restricted)	Origin (indigenous, state, NGO, project)	Sphere of operation: community, local, beyond local	Sources of funding (members, external, both)	Existed how long (less than 1 yr, 1-5, longer)	Formal or informal
1	Anganwadi	Provides food, vaccinations, and medicine to children up to 6 years of age as well as to pregnant and lactating women. Acts as a preparatory school	Children up to 6 years of age, pregnant and lactating women	Open	State	Community	External	Longer	Formal
2	School	Provides education to children and mid-day meal	Whole community (Students)	Open	State	Community	External	Longer	Formal
3	PDS	Provides cereals and pulses to households	Whole community	Open	State	Community	External	Longer	Formal
4	Gram Panchayat	Local governing body which resolves local issues and, if required, passes them on to the block and district office. Facilitates all the development activities as well.	Whole community	Open	State	Community	External	Longer	Formal
5	Bank	Provide loans to the farmers.	Most of the community	Open	State	Local	Both	Longer	Formal

B. Organizational landscape of food security

The goal of this exercise was to obtain more information on the organizational landscape contributing to the food security of Pakhana village. Food security is mostly measured at the household level. Nonetheless, community-level organizations influence the food security of social groups within the community differently. Male and female participants were first asked to discuss the concepts of food availability, access, and utilization, before reviewing each organization previously identified by pointing out which of them had activities that fell under these categories. Organizations identified by the men's and women's groups are shown in Figures 3 and 4.

The men's group identified two organizations working on food security while the women's identified three. Food security was explained in terms of both physical and economic access to food. It includes year-round food security in a household, through their own farms or from other sources. The concept of food security was further divided into availability, accessibility, and utilization of food. Food security was also explained to include the entire household, not leaving behind any individual member of the household.

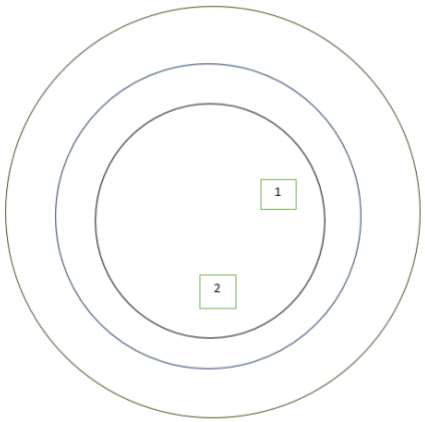
The male focus group discussion participants belonged mostly to economically prosperous families and were not much concerned by food security issues. The two organizations identified by the men's group included the school and Anganwadi centres. The women's group added the PDS shop to the list. During the FGDs, it was noted that the women were more concerned about food security issues than men in the area.

The school provides a mid-day meal to the children while the Anganwadi centers provide nutritious food rations to children below the age of 6 years and to pre and post-natal women. The PDS shop provides cereals, pulses, and sugar to people every month. These organizations provide food to children, mother, and poorer households. This helps in reducing the nutrition gap observed in the baseline study. These organizations were also reported during the baseline study, and they have continued to exist and function within the village in the last five years. Villagers particularly

appreciated the PDS, school, and the Anganwadi centres for fulfilling the role of government in food security support.

The men's group identified 12 organizations during the baseline study compared to the two identified during the midline village study. The reason for this can be explained by the fact that the organizations identified during the baseline were indirectly linked to food security by providing indirect benefits and financial aid. Similarly, the women's group identified 5 organizations related to food security during the baseline study. Reasons for non-inclusion in the midline study are detailed in the table below.

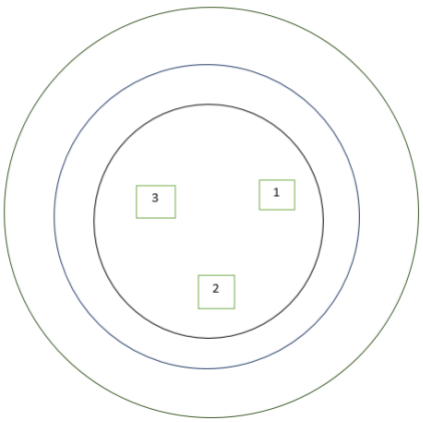
Figure 3. Organizational landscape of food security according to the men's group



Legend

1	School
2	Aanganwari

Figure 4. Organizational landscape of food security according to the women's group



Legend

1	Aanganwari
2	School
3	PDS

Table 9. Organizations that did not appear in the food security landscape during the midline study

Women	
Name of organization	**Why were they not included in the midline organizational landscape**
Gurudwara	The Gurudwara was an important site for migrant labourers who sometimes could not feed themselves, and the Gurudwara was providing free Langar (food offering) for free.
Water Tank	The condition of the water supply has improved directly. This is not a very influential organization in ensuring food security.
Men	
Name of organization	**Why were they not included in the midline organizational landscape**
Gram Panchayat	The Gram Panchayat monitors the school through the Village Education Committee and the Anganwadi centres (indirect benefits not direct to food security)
PDS	The men's group did not consider it of muchimportance as the participants were from a wealthy socio-economic group. The PDS is more relevant for marginal sections of the society.
Primary Agricultural Credit Cooperative Society (PACS)	This organization has only indirect benefits in food security as it provides financial aid
Agricultural Produce Market Committee (APMC, Mandi)	Mandi buys farm outputs at fixed prices which gives economic security
Department of Animal Husbandry	No direct relevance
Block Agriculture office (Department of Agriculture) and Agricultural Development office	Indirect benefits to farmers
Central Bank	Provided Financial Aid but has no direct relation with food security

Table 10. Organizations that did appear in the food security landscape during the midline but not during the baseline study

Women	
Name of organization	**Why did they not appear in the baseline study**
None	None
Men	
Name of organization	**Why did they not appear in the baseline study**
None	None

C. Organizational landscape of natural resource management

In this section, the organizational landscape in relation to natural resource management (NRM) is discussed. Specifically, this section presents the organizations which were identified as actively working in NRM related areas. The process entailed

asking the two groups to first identify the organizations involved in the management of natural resources in the community and develop a list of natural resources important to the livelihoods of the community, before deciding on a symbol for each type of natural resource listed.

The men's group identified five organizations working in NRM related areas, whereas the women's group identified three organizations. All the organizations mentioned by the two groups were either local government or regional government organizations. The organizations working in managing natural resources such as water, land, livestock, etc. included the Gram Panchayat, the Block Agricultural Office, the Department of Electricity and the District Animal Husbandry Office. The majority of the organizations focused on agriculture and livestock, but with increasing concerns related to water stress and climate change stressors, the organizations are now focusing on creating awareness among farmers on climate change impacts and sustainable agricultural practices.

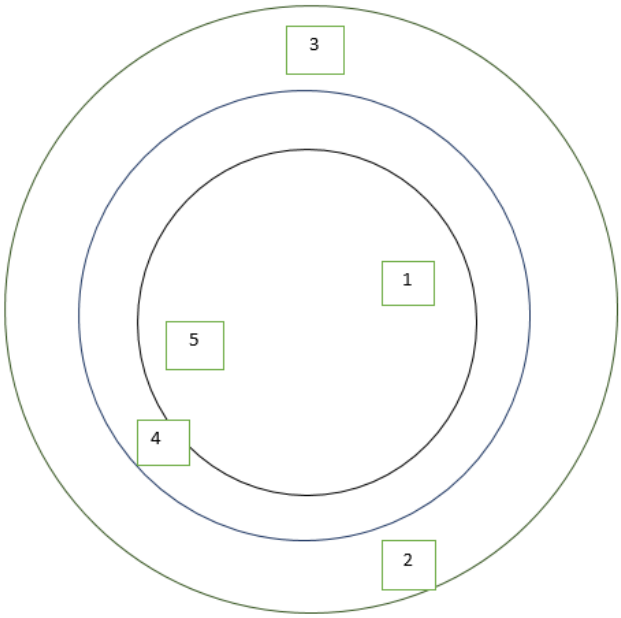
Since the baseline study, there were no new organizations mentioned by the group members that have started working in the field of NRM. However, the men's group stated that the Department of Forestry which was reported at the time of the baseline is no longer working actively as there is no forest in the village and all lands are converted into farmlands.

During the midline study, the women's group did not mention the Department of Electricity which is in charge of regulating the water supply to the village and farmlands.

The organizations listed focus on inputs, technology, climate change awareness and community infrastructure. Currently, the flagship programme of the Government of India, i.e., Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS), which provides 100 days of employment is channelled through the Gram Panchayat. The funds of MGNREGS are used to create community infrastructures for Natural Resources Management. One of the most significant gaps found among identified organizations was that none were working specifically in NRM other than those working in livestock and agriculture. Women participants were less aware of NRM, climate change and related organizations than men participants

were. As a result, women were unable to recall the names of many organizations or to detail their activities. Both men and women participants wished for more agriculture-related support to NRM, such as the provision of inputs and training.

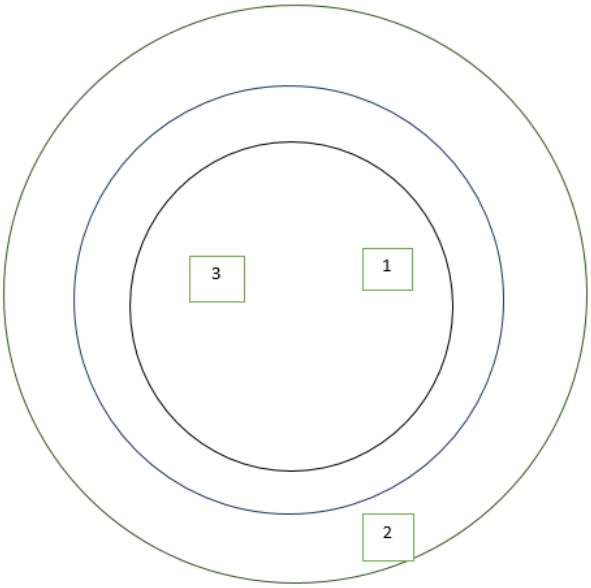
Figure 5. Organizational landscape of natural resource management – men



Legend

1	Panchayat
2	Block Office
3	District Agricultural Office
4	Electricity Department
5	District Animal Husbandry Office

Figure 6. Organizational landscape of natural resource management – women



Legend

1	Panchayat
2	District Agricultural Office
3	District Animal Husbandry Office

Table 11. Organizations that did not appear in the natural resource management landscape during the midline study

Women	
Name of organization	**Why were they not included in the midline organizational landscape**
None	None
Men	
Name of organization	**Why were they not included in the midline organizational landscape**
Department of Forestry	No longer actively working in the village

Table 12. Organizations that appeared in the natural resource management landscape during the midline but not during the baseline study

Women	
Name of organization	**Why did they not appear in the baseline study**
None	None
Men	
Name of organization	**Why did they not appear in the baseline study**
Department of Electricity	The farmers are more aware now of groundwater exploitation and the subsidized electricity that is available to the farmers

D. Gender differences between organizational landscapes

Table 13 below summarizes information on all the organizations identified by the men's and women's groups. The organizations are classified according to their role in supporting food availability, access and utilization as well as the management of natural resources.

Table 13. Information on highlighted organizations of men and women (unless otherwise noted, 1=yes, 0=no)

Organizational Landscape	Men					Women				
Name of organization	Org. ID by men	Sphere. 1=village 2=locality 3=Beyond locality	Food security	Food crisis	NRM	Org. ID by women	Sphere. 1=village 2=locality 3=Beyond locality	Food security	Food crisis	NRM
School	1	1	1	0	0	1	1	1	0	0
Anganwadi	1	1	1	0	0	1	1	1	0	0
APMC (Mandi)	1	2	0	0	0	1	2	0	0	0
Panchayat	1	1	0	0	1	1	1	0	0	1
Bank	1	2	0	0	0	1	2	0	0	0
Dept. of Electricity	1	3	0	0	1	0	-	-	-	-
Block Office	1	3	0	0	1	0	-	-	-	-
Dist. Agriculture Office	1	3	0	0	1	1	3	0	0	1
Department of Animal Husbandry	1	1	0	0	1	1	1	0	0	1
PDS	1	1	0	0	0	1	1	1	0	0
TOTALS	10	1 = 5 2 = 2 3 = 3	2	0	5	8	1 = 5 2 = 2 3 = 1	3	0	3

Topic 3: Information networks

The exercise aimed at understanding the available options for the villagers to access agriculture and weather-related information, the use that people make of this information, as well as mediums of transmissions.

The men and women's groups identified 19 sources of information. The men's group reported that their main interests were in farming, weather, prices, plant protection and climate change related information. The women participants were more interested in weather, farming, livestock, and health and nutrition-related information. Agriculture was the most sought-after type of information for men, followed by climate change and weather and prices. Women reported accessing equally all kinds of information. Among the most sought-after weather-related information, rain forecasts were the most common with few people seeking extreme weather-related information.

Access to information is facilitated through existing home appliances such as phones, mobiles, television, radio benefiting from infrastructures such as electricity. Among men and women, the most popular sources of information were friends, relatives, neighbours, radio and television. While other sources are readily available, including free mobile phone access to price information, participants used them less frequently. Television programs such as AgriWorld were popular in providing men and women access to agricultural information. Women noted that their limited access to markets and poor literacy were limiting factors. Given these limitations, women reported obtaining most of their information from agricultural and livestock product suppliers, discussing with those who have travelled outside Pakhana, and engaging with teachers, parents and neighbours.

Table 14. Networks of information as identified during the baseline study

Information source	Topic (women)				Topic (men)				
	Weather	Agriculture	Livestock	Health and Nutrition	Weather	Agricultural Marketing	Agriculture	Climate Change	Total
Friends/ Relatives	1	1	1	1	1	1	1	1	8
Neighbour	1	1	1	1	1	1	1	1	8
Middlemen	0	0	0	0	0	1	0	0	1
Agro Metro Dept.	0	0	0	0	1	0	0	0	1
IFFCO Sanchar	0	0	0	0	1	0	1	1	3
PACS	1	1	0	1	0	0	0	0	3
Govt Call Center	0	0	0	0	1	0	1	0	2
Agro Dept.	0	0	0	0	0	1	0	1	2
ICAR	0	0	0	0	0	0	1	0	1
Radio/TV	1	1	1	1	1	1	1	1	8
Newspaper	0	0	0	0	1	1	1	1	4
Observation	1	1	1	1	0	0	0	0	4
Agro-Vet	0	0	1	0	0	0	0	0	1
Trainings	0	0	0	1	0	0	0	0	1
Market	1	1	1	0	0	0	0	0	3
Grain market	0	0	0	0	0	1	0	0	1
Agro fairs	0	0	0	0	0	0	1	1	2
Input traders	0	0	0	0	0	0	1	0	1
Agro Campaign	0	0	0	0	0	0	1	1	2
Total	6	6	6	6	7	7	10	8	

Table 15. Changes in the sources of information for different topics (type of information) as mentioned by women

Type of information	New source of information that has become available	Sources of information that are no longer used
Weather	Internet	-
Agriculture	Internet	-
Livestock	-	Agro-Vet
Health and nutrition	-	-

Table 16. Changes in the sources of information for different topics (type of information) as mentioned by men

Type of information	New source of information that has become available	Sources of information that are no longer used
Weather	Internet, SMS	IFFCO Sanchar, Agro Metro Dept.
Agricultural marketing	Internet, SMS	Middlemen, Agro Dept.
Agriculture	Internet	IFFCO Sanchar, ICAR, Input traders
Climate change	-	IFFCO Sanchar, Agro Dept.

Both men and women identified multiple sources of information on various topics such as farming, weather, livestock, water usage, climate change, etc.

Some of the sources of information were TV, Training programs, Agro Fairs and Campaigns, SMS, PACS, Newspaper, Market, Mandi, etc. One of the most common and emerging sources of information among the villagers was the internet. The internet has helped the villagers in gaining knowledge on different farm activities, including seed inputs, pros and cons of fertilisers, organic farming, different breeds of cattle, etc.

Many of the sources of information no longer available included IFFCO Sanchar, ICAR, Agro-Vet, and Input Traders.

The men's group identified new topics on which they are now being informed, which included information about organic farming, using zero tillage for wheat, using specific varieties of seeds, etc.

Table 17. New topics (types of information) mentioned by men and women

Type of information	Mentioned by men/women
Different farming activities (CIMMYT): Zero Tillage	Men
Organic farming (Internet)	Men

Conclusion and recommendations

Pakhana is located in the Karnal district of Haryana state and situated in the fertile flat land of India's Indo-Gangetic plains. Pakhana is a highly developed agricultural village with very high productivity in both agriculture and livestock. Most of the people who migrated from Pakistan are prosperous and benefited from the Green Revolution. Compared to what was reported during the baseline study, the village now has excellent road connectivity to neighbouring towns, and the streets are well paved within the village itself. The water supply system has improved with a proper sewage treatment system through a pipeline. The village also has developed its facilities near the crematorium. There are still no health centres in the village, and the school has not improved. It still only provides education up to the 8th standard.

Basmati rice and wheat, which are the main crops of the area, are cultivated commercially and sold at nearby Mandis, such as the one located at Taraori. There are about 15 to 20 rice mills near Pakhana village. The area is highly mechanized; the earlier abundance of cheap labour from the eastern Indian states has waned over the years, compelling farmers to mechanize the operations. However, transplanting is still done using manual labour. Use of chemical inputs is also very high in the village. Nonetheless, there is growing awareness among farmers on the consequences on soil fertility. Some farmers have experimented with organic farming but the low yields are met with apprehension by farmers. Nevertheless, the crops produced organically reach premium prices at the local market, with consumers more and more concerned about health. Some of the crops that are no longer cultivated include pulses, sugarcane, and millets. A majority of the households stopped growing tomatoes as reported in the baseline, the primary reason being the inability to fetch a reasonable market price for tomatoes.

The Green Revolution in the semi-arid region has brought prosperity among farmers who have exploited the natural resources heavily. Rice and wheat need four to six times irrigation in the absence of assured rainfall, which is noted to be erratic and low. In Pakhana village alone, the groundwater has gone down to 85 feet below ground. The farmers use high powered pump sets 24/7 for about 60 days to cultivate Basmati rice and wheat. As the production is season bound, the farmers do not wait for the rains to arrive in case of delayed monsoon. Transplanting needs inundation of the field and groundwater is consequently used. Significant issues related to landholdings along with the lack of groundwater recharge and over-exploitation of the aquifers are concerns raised during the study. The canal system does not provide adequate irrigation on the farmlands.

Almost all the households rear milch cow and buffaloes in their households. The milk is sold commercially and some is used for own consumption. Fodder crops like clover, sorghum, maize, and berseem are cultivated. The manure is applied in agricultural fields. However, there is a possibility to increase the speed of the process of composting by using vermicompost and NADEP composting methods. Rearing small livestock in the area is on a decline due to lack of grazing land.

The community vision of the future is about better internet connectivity, better electricity supply, and better prices for farm produces. There are concerns about falling groundwater and growing pollution. Groundwater recharge is an immediate need and the villagers need help. The villagers do understand the advantages in taste and the health benefits of organic farming. They are also interested in better management of solid waste disposal.

The men’s group identified ten organizations in the village while the women’s group identified eight. Eight of the identified organizations were similar among the two groups, and the majority of the organizations identified were operating within the community. The organizations are mostly linked to agricultural and livestock production, markets, and food security. All the organizations have been working within the community for long. The majority of the organizations are owned or affiliated with the government. While the identified organizations are related to high productivity and markets sales, the organizations related to food security and NRM

are almost overlooked. The men participants only identified the mid-day meal scheme and the Anganwadi centres to be involved in food security. The women added PDS shop as another organization working towards food security. On NRM, there are no organizations apart from the MGNREGS scheme. The agriculture department has tried to promote maize as a water saving crop, but has failed due to low market price. The alarming groundwater depletion, semi-arid climate of the area and future water needs would require the immediate attention to be on groundwater recharge and adoption of water saving agronomic practices.

Both men and women identified various sources of information on different topics from farming, weather, livestock, water usage, to climate change. Some of them were TV, Training programs, Agro Fairs and Campaigns, SMS, PACS, Newspaper, Market, Mandi, etc. One of the most common and emerging sources of information among the villagers was the internet. Access to internet has helped the villagers in gaining knowledge on different farm activities and practices, including seed inputs, pros and cons of fertilisers, organic farming, different breeds of cattle, etc. Some of the sources of information which are no longer available include IFFCO Sanchar, ICAR, Agro-Vet, and Input Traders. The men's group mentioned some of the new topics on which they are being informed, which included information on organic farming, using zero tillage for wheat, using specific varieties of seeds, etc.

Implications for CCAFS and recommendations of major opportunities

As mentioned in the baseline study, the recommendations remain the same for diversification of livelihoods, the introduction of climate-resilient varieties and the improvement of water resources. The research team would suggest the same for interventions in agriculture. Apart from recommendations given at the time of the baseline, newer methods and practices in crop cultivation, such as direct seeding in rice and wheat crops (avoidance of transplanting), alternate wetting and drying for irrigation needs to be encouraged. There should be subsidies for the promotion of low water consuming crops, organic farming, and ground water recharge. Massive awareness campaigns are required for farmers on water saving and organic farming.

Incentives should be implemented to encourage farmers to save power, as has been the case in the neighbouring state of Punjab2.

With deficient rainfall, there is little or no regulation to discourage water inefficient crops. There is a lack of collective thinking on water conservations in the context ofprivate properties. Large holdings are often owned by wealthy and powerful farmers, who operate on an economy of scale and rarely consider water conservation issues. Smallholders, whose food security is dependent on smaller land sizes, are dependent on higher inputs uses, including water. The behavioural patterns of the private landowner are also bearing on conservation/ augmentation and use. Similarly, subsidized and free power distribution for agricultural purposes is promoting the indiscriminate use of groundwater. Investments by the Water Resource Department are mostly focused on large and medium scale irrigation dams and channels through the canal network. This does not create an enabling environment for ground water recharge, and evapotranspiration losses are higher than through smaller structures. Funding for the creation of water harvesting structures suited to the local context can now be done with the Mahatma Gandhi National Employment Guarantee Scheme.

The Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS) provides unique opportunities to improve the natural resources of the village. The MGNREGS gives funding for the creation of structures, plantations for in-situ soil and moisture harvesting. There have been various examples in nearby Jharkhand and West Bengal (https://usharmukti.nregawb.in/). In those cases, funding has been used for groundwater recharge, creation of community infrastructure, improving agricultural productivity, which ultimately improves livelihoods and helps mitigate climate change impacts.

In semi-arid regions, the Gujarat state has demonstrated that innovative technologies such as Bhungroo are helpful in groundwater recharge. Similarly, the creation of traditional water harvesting system such as Johad, Khadin must be tried to improve soil-moisture availability and use of low water requirement crops.

2http://images.tribuneindia.com/news/punjab/peasants-to-get-cashback-for-saving-power/532722.html

https://unfccc.int/climate-action/momentum-for-change/women-for-results/bhungroo

For low-income families, who are smallholders, landless and labourers andin need of diversification in livelihoods, the Haryana State Rural Livelihood Mission (HSRLM) has started working in the village and has mobilized the women under the ambit of Self Help Groups (SHGs). The farm-based livelihoods operations will begin soon in the village. Microenterprise are being supported and skill training with the support of HSRLM are provided for the youth, which will increase livelihoods options.

The piles of dung seen around the village need to be composted through various methods for better manure quality and removal of pathogens. These methods are vermicomposting, NADEP composting, and hot composting. As the compost is ready within 30 to 60 days, it would ensure an increase in the application of organic manure on farmlands. The manure can also be sold commercially.