Adapting to Change

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EdelGive Foundation
An Edelweiss Initiative

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Understanding the experience of
creating climate resilient rainwater harvesting and farming

Study conducted under Community led
Drought Mitigation (CDM) Project

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Study conducted under Community led Drought Mitigation (CDM) Project

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ISBN 978-81-970765-3-4

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Executive Summary

GRAVIS has been implementing the project Community led Drought Mitigation (CDM) in two districts of Thar region of Wester Rajasthan for last four years. The major focus of the project is to understand impact of climate change on desert communities and accordingly implement innovative solutions on Climate Smart Agriculture and Climate Resilient Water Harvesting.

The current study on Climate Resilient Rainwater Harvesting and Farming has been undertaken as part of the project activities. The study seeks to document the experience of the CDM project in creating climate resilient rainwater harvesting and farming. After discussion with the project management, it was decided to focus on

- How climate change is adversely affecting dryland farming in arid zones
- What opportunities (in the same context) are being presented
- How have communities coped so far - best practices
- What can we foresee as a long-term vision (communities' role in climate resilient agriculture, replication, data)
- Key advocacy messages to influence global policy and resource allocation

The methodology adopted is a mix of primary and secondary sources. Extensive literature research was undertaken to understand the climate change in arid zone of Rajasthan, its impact on dryland agriculture, and measures proposed by experts to tackle climate change. This was backed up with a study of the project reports – the proposal and the various progress reports to understand the project interventions, their impact on the ground. A field visit was undertaken for ground truthing.

The Western Rajasthan districts rank high on agriculture vulnerability and climate hazard vulnerability. The region is experiencing the impact of climate change with a dramatic rise in extreme events. Long term studies show an increase in precipitation that will impact the local agriculture and livelihoods. On the other hand, parts of the desert are seeing an increase in irrigated agriculture with borewells coming up.

During a meeting of the Village Development Committee, the representative community body at the village levels that manages project interventions at village level, the committee members described the impact of a taanka getting full of rainwater as having half a jamana, meaning that they have water security for half an year. The khadins conserve soil, water, and manure and can lead to a four-fold jump in production. The AHUs constructed under the project are yet to fruit fully, but the trees are growing rapidly. The local community is also beginning to adapt the measure, developing its own AHUs. The Community Seed Banks have doubled the stock of seed they had at the time of being set up during the project duration.

The coping mechanisms prescribed by experts focus on revival of traditional systems of agriculture that has been undergoing changes with ingress of irrigation. The Rajasthan State Action Plan on Climate Change recommends diversification of sowing patters, cultivation of less water intensive crops, and adoption of rain water harvesting systems at both farm and household level. The domain expert interviewed for the project has made similar recommendations. The intervention carried out under the CDM project are perfectly aligned with these recommendations.

Climate change has rightly become probably the most prominent issue globally with an international gathering – Conference of Parties – every year to monitor the standards set in Paris Protocol. However, most of the attention is focused on reduction in emissions. The funding for adaptation measures is woefully short. There is need to make local communities aware of the impending changes and take steps to ensure that they adapt their livelihoods and lifestyles with climate change in near future. This calls for an increased support for adaptation measures in the strategy and programs that seek to address climate change.

Chapter 1
Introduction

Gramin Vikas Vigyan Samiti (GRAVIS) is implementing the project titled Community led Drought Mitigation (CDM) in Baap tehsil of District Jodhpur now Phalodi in Rajasthan. The major focus of the project is to understand climate change impact on desert communities and accordingly implement innovative solutions on Climate Smart Agriculture and Climate Resilient Water Harvesting. Community led Drought Mitigation (CDM) is a vision carved out as a result of all of GRAVIS interventions and experiences over last three and a half decades. This is an integrated development project aimed to address three critical inter-related aspects of drought mitigation. – 1) enhancing food and water security in the communities for humans and livestock, 2) improving the health and nutritional status of communities and, 3) mobilization of communities, their capacity building and developing local skills in drought mitigation along with gender equity.

GRAVIS, an NGO in Thar Desert, Rajasthan, has been working to empower the rural communities for the last 40 years. The organization emphasizes on water security, food security, education and healthcare, through an integrated approach towards rural development. It focuses its efforts on the restoration of dwindling natural resources and on the promotion of marginalized groups. The organization blends traditional wisdom with new techniques to create long-term, sustainable and cost-effective means for improving the lives of rural inhabitants. In order to achieve its overall goal of creating self-reliant village communities, it strives to involve the local communities in its programmes and interventions, train and build their capacities in order to develop community ownership.

The CDM project is aligned with vision of GRAVIS and its activities are designed to make communities self-reliant, confident and prudent for environment friendliness. The mission of the organization is to ensure that the collective efforts of marginalized and other impoverished communities become financially independent and to establish *Gram Swaraj* – village self-rule, one of the prominent Gandhian ideology, which forms the genesis of organization.

The current study on Climate Resilient Rainwater Harvesting and Farming has been undertaken as part of the project activities. The study seeks to document the experience of the CDM project in creating climate resilient rainwater harvesting and farming. The study will examine how project activities have led to creation of climate resilient rainwater harvesting structures and farming processes.

The consultant discussed with project staff and GRAVIS management on what all should be the content of the study. It was decided that the study should cover following topics

- How climate change is adversely affecting dryland farming in arid zones
- What opportunities (in the same context) are being presented
- How have communities coped so far - best practices - CDM, GRAVIS

- What can we foresee as a long-term vision (communities' role in climate resilient agriculture, replication, data)
- Key advocacy messages to influence global policy and resource allocation

Methodology

The methodology adopted is a mix of primary and secondary sources. Extensive literature research was undertaken to understand the climate change in arid zone of Rajasthan and its impact on dryland agriculture. This was backed up with a study of the project reports – the proposal and the various progress reports to understand the project interventions, their impact on the ground. A field visit was undertaken for ground truthing. A brief survey was also undertaken to assess community's response. Experts on impact of climate change on dryland agriculture were interviewed to get their opinion on the climate change and possible coping mechanisms.

The methodology is listed below

- Secondary literature review to understand the impact of climate change on dryland agriculture
- Review of project documents to assess impact of project interventions
- Field visit to project villages to assess the impact first hand
- Interviews with subject matter specialists

Chapterisation

The report is aligned along following chapters

1. Introduction
2. Impact of climate change on dryland farming in desert areas and the opportunities presented
3. How are communities coping,
    a. The CDM project interventions planned and executed
    b. The field work findings
4. Long term vision – communities' role in climate resilient agriculture, replication
5. Key advocacy messages to influence global policy and resource allocation

Chapter 2
Impact of Climate Change on Dryland Agriculture in Arid Zones

The year 2023 saw one of the longest breaks in monsoon in Rajasthan. After good rains in July, there was no rain for almost the whole month of August. The long dry break spelled disaster for the main staple crop of bajra in the arid zones. The crop dried up except in the *khadin* areas. However there has been good production of the other major crop of guar, that is a cash crop. So, the drought has been averted. The story is illustrative of the resilience of traditional agricultural practices in face of climate change. While breaks in monsoon are common, the long month-long break was unusual and can be attributed to climate change. The traditional dryland agriculture practice in the project region in some of the driest parts of the desert has been to undertake mixed cropping. A mix of five crops – *baajra, mung/moth, guar, til, and matira* – are sown together. The guar is also sown as a monoculture. The logic is that if the rainfall pattern is not suitable to one or more crops, at least some other crops will survive. The logic bore perfect results this year.

The rainfall pattern of the state has been changing over the past three decades. According to the India Meteorological Department, there has been an increasing trend in the number of rainy days in the year, and heavy rainfall days during monsoons have risen in several districts. IMD's analysis says that between 1989-2018, a period of 30 years, there has been a "significant" increase in heavy rainfall days in the entire year, particularly for the western parts of the state (Azra Parveen 2022).

Environmental changes, including changing rainfall patterns and vegetation, have affected Rajasthan's desert ecology, impacting local flora and fauna. Rajasthan, the desert state of India, was in the news this July and August for the unusually heavy rains that lasted days, flooding towns and cities and marooning villages. The city of Jodhpur received 118 mm of rainfall in 24 hours on July 25-26.

Heavy rainfall days indicate more than 65 mm of rain in a day. The analysis also points to an increase in the total number of rainy days in a year for several districts within the same period. The draft Rajasthan State Action Plan on Climate Change (RSAPCC 2022) also says that the western part of the state shows an increasing trend of more than 2 mm of rainfall per year, and so does the southeastern part. "The annual maximum rainfall shows a positive trend in several grids spread all over Rajasthan," the action plan said.

A recent study published in Earth's Future forecasts significant increase in rainfall over the Thar desert. In contrast to the "wet gets wetter and dry gets drier" paradigm, here, using observations and climate model simulations, the researchers PV Rajesh and BN Goswami show that the mean rainfall over the semi-arid northwest parts of India and Pakistan has increased by 10%–50% during 1901–2015 and is expected to increase by 50%–200% under moderate greenhouse gas (GHG) scenarios. The GHG forcing primarily drives the westward expansion of the Indian summer monsoon rainfall (ISMR) and is facilitated by a westward expansion of the Indian Ocean (IO) warm pool. Mechanistically, the westward expansion of ISMR is a consequence of the episodic genesis over IO and the northward propagation of an expanded Inter-Tropical Convergence Zone on a sub-seasonal time scale. While an adaptation strategy to increased

hydrological disasters is a must, harnessing the augmented rainfall would lead to a substantial boost in food productivity, bringing transformative changes in the socio-economic condition of people in the region (Rajesh PV and Goswami BN 2023).

The period of 1951-2015 shows positive trends in some grids for total annual rainfall, but no trends are visible in monsoon precipitation (Fig. 2.3). Annual maximum rainfall shows a small positive trend in south-western grids. Non-monsoon rainfall shows a small positive trend in the western and northern part of the state.

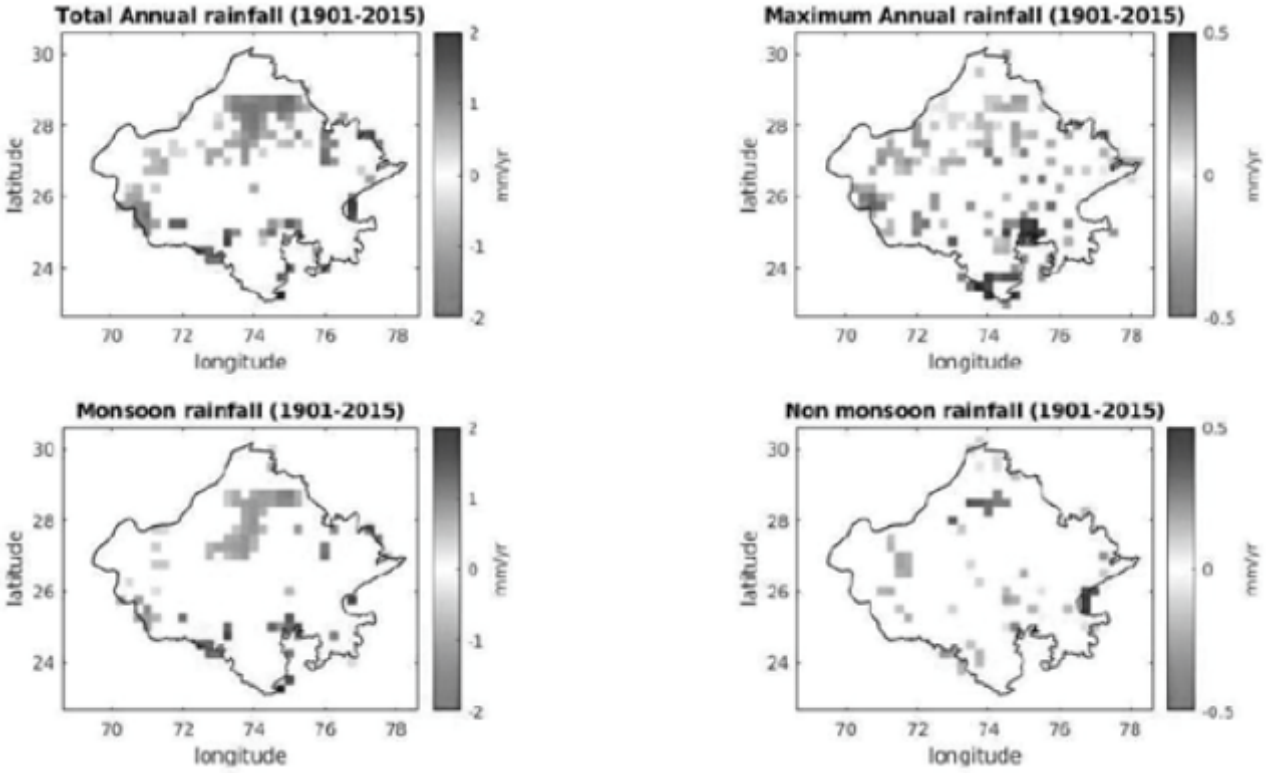


Figure 1: Trend in total annual rainfall, annual maximum rainfall, monsoon rainfall and non- monsoon rainfall for period 1901-2015 (RSAPCC 2022).

The total annual rainfall and monsoon rainfall show positive trends in the northern districts of Rajasthan (Fig. 2.4). The annual maximum rainfall shows a positive trend in several grids spread all over Rajasthan. Most grids do not show any trends for non-monsoon rainfall. The trends were calculated using modified Mann Kendall's method discussed in detail in Methods section.

Impact of climate change on agriculture

Plants encounter several biotic and abiotic stresses, usually in combination. This results in major economic losses in agriculture and forestry every year. Climate change aggravates the adverse effect of combined

stress and increases such losses. The abiotic stress factors include high temperature and drought while the biotic stress factors include insect pests, pathogens and parasitic plants. (Teshome et al., 2020)

Biotic and abiotic stress factors cause major economic losses by reducing yield and quality in agriculture and forestry. A global survey on the major food crops indicated that pathogens, insect pests and weeds cause average yield losses ranging from 17.2 percent in potato up to 30.0 percent in rice (Savary et al., 2019). Similarly, the major abiotic stresses such as temperature extremes, drought, as well as the deficiency and toxicity of plant nutrients cause up to 51-82 percent annual loss of crop yield in the world (Oshunsanya et al., 2019).

Agriculture vulnerability can be defined as the degree to which an agricultural system is susceptible to harm or unable to cope with the adverse impacts of climate change. The Rajasthan State Action Plan on Climate Change has explored in depth the agriculture vulnerability The plan identified 25 variables (or indicators) and collected district-level data for study. Out of the 25 indicators, 20, which represent various agricultural factors, were used to construct the agriculture vulnerability index (AVI), and the remaining five indicators, representing climate hazard variability, were used for the construction of a hazard index (HI).

The districts with the highest agriculture vulnerability are clustered in the west, those with high vulnerability are clustered in the central part, and the districts with the least vulnerability are clustered in the east.

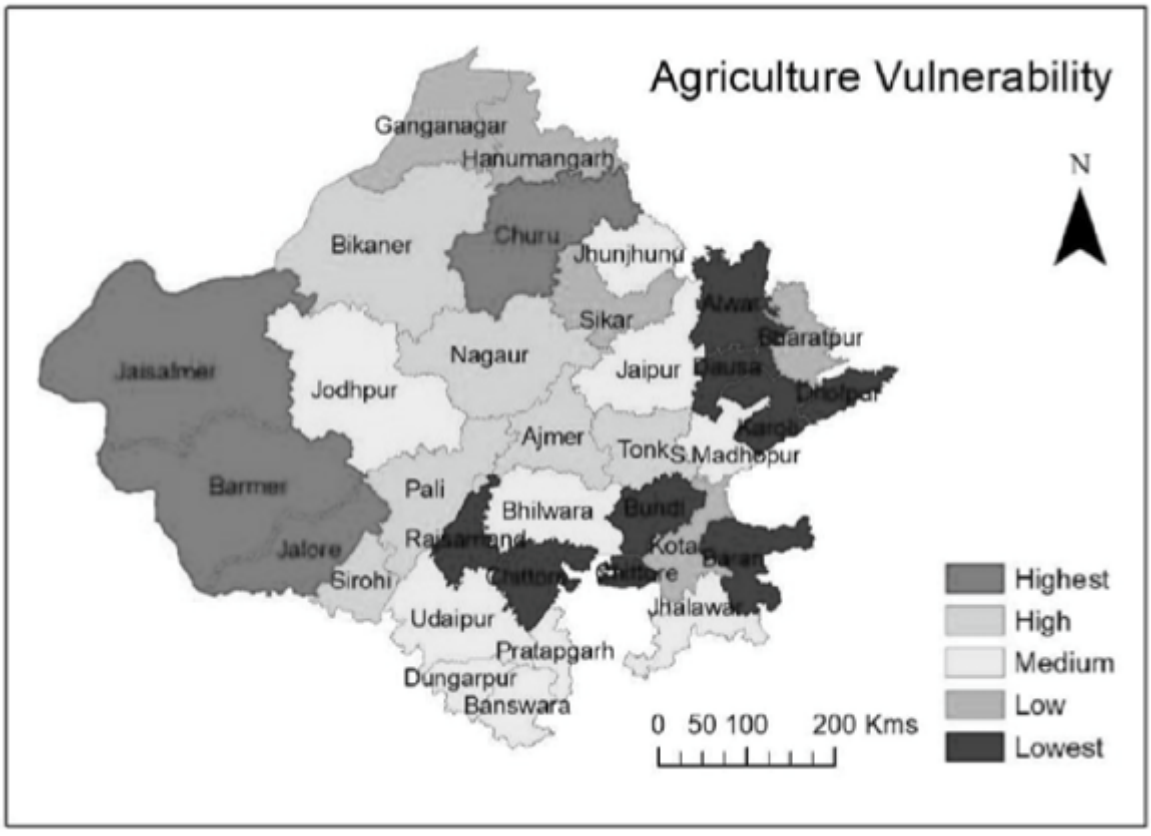


Figure 2: Agriculture Vulnerability in Rajasthan (RSAPCC 2022)

Hazard: The study collected district level data on variables that determine climate hazard variability, such as annual rainfall, monsoon rainfall, deviation from normal rainfall, deviation from monsoon rainfall and drought occurrence. The data was used to calculate a Hazard Index that is shown in the map below. It can bee seen that the districts with high hazard vulnerability are clustered in the Western parts of the state.

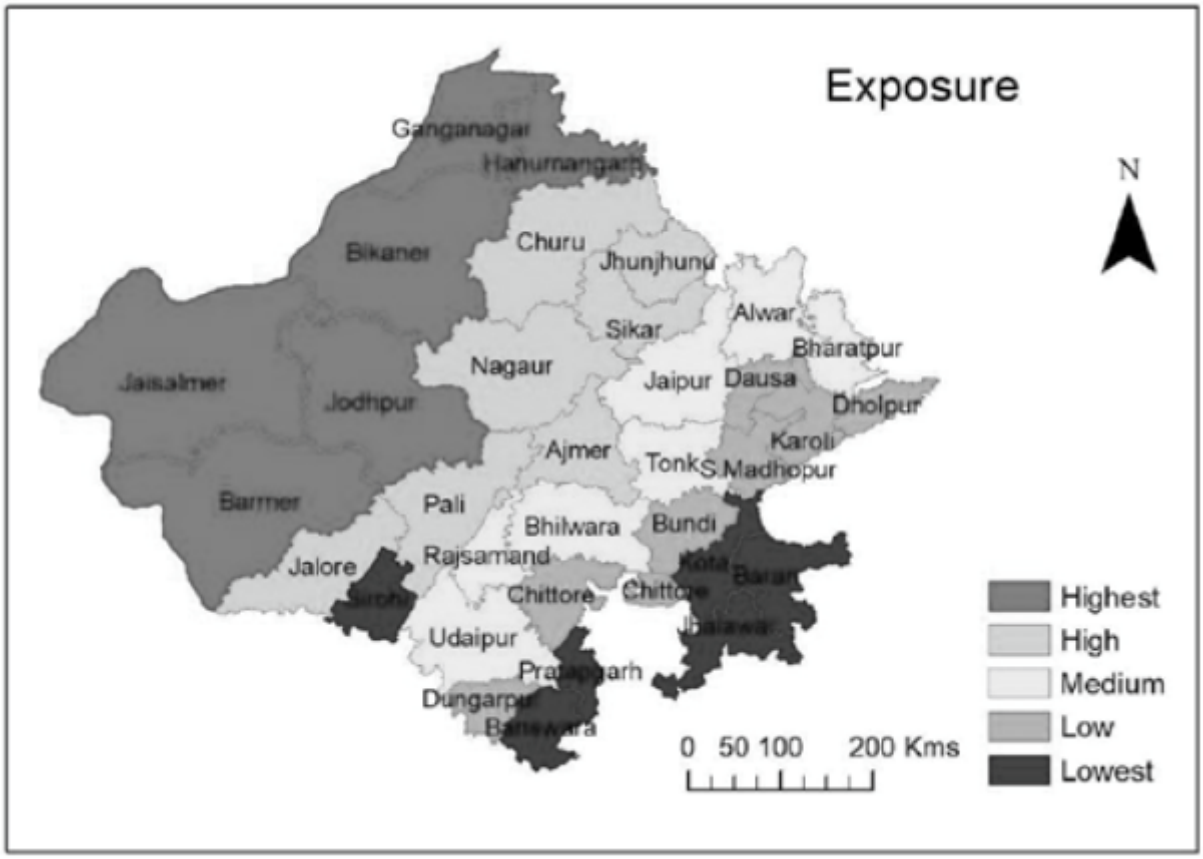


Figure 3: Climate Hazard Vulnerability in Rajasthan (RSAPCC 2022)

The study carried out a correlation exercise between the two indices and found that there exists a high degree of correlation between the two indices. Agriculture vulnerability in Rajasthan is linearly dependent on hazard variability in the state. That is, the districts with high hazard variability tend to have high agriculture vulnerability. The district-wise indices and district-wise ranking of agriculture vulnerability and hazard are given in Table 4.8

Chapter 3
Coping with Climate Change

This chapter focuses on the coping mechanism of desert communities. Its focus is the project interventions that are designed to cope with climate change. The chapter is divided into two sections. The first section looks at the total number of outputs achieved under the project. The second focuses on a qualitative assessment of the outputs as observed during the field visit.

3.1 Project Outputs

The project sought to achieve its goal through a series of interlinked objectives that included (i) Understanding climate change impact on desert communities and accordingly implement innovative solutions on climate smart agriculture and climate resilient water harvesting (ii) Mainstreaming gender into drought mitigation programmes to empower women and to develop women leadership (iii) Linking drought mitigation with formal education (iv) Establishing linkages between drought mitigation and overall wellbeing through addressing health, nutrition security, water quality and poverty reduction (v) Documenting best practices, research on community perspectives and develop training materials for long-term use and for capacity building of grass root level organizations focusing on drought mitigation.

The project has carried out most of the activities planned to achieve project objectives. The table below lists outputs achieved against the targets

Table 1: Project Outputs – Target and Achievements

Sl.	*Objective*	*Activity*	*Target*	*Ach.*	*Remarks*
1	Understand climate change impact on desert communities and accordingly implement innovative solutions on climate smart agriculture and climate resilient water harvesting.	Construction of *taanka*	250	250	Completed
2		Construction of *Khadin*	250	250	Completed
3		*Naadi*/ Pond renovation	2	2	Completed
4		Pasture development	2	2	Completed
5		Technical training on rain-fed farming	50	50	Completed
6		Technical Training on rainwater harvesting	50	50	Completed
7		Seed Banks	10	8	Completed

1	Mainstream gender into drought mitigation programmes to empower women and to develop women leadership	Self Help Groups formed	20	20	Completed
2		SHG Leadership Training	20	20	Completed
3		SHG Vocational Training	20	20	Completed
4		Capital Assistance to SHGs	20	20	Completed
1	Link drought mitigation with formal education	Girls Scholarship	200	200	Completed
2		Drought Education Sessions	100	100	Completed
3		World Water Day	5	5	Completed
1	Establishing linkages between drought mitigation and overall wellbeing through addressing health, nutrition security, water quality and poverty reduction.	Establishment of AHUs	250	250	Completed
2		Outreach Medical Camps	50	50	Completed
3		Community Health Training	50	50	Completed
4		Water Filters	250	250	Completed
1	Document best pr actices, research on community perspectives and develop training materials for long-term use and for capacity building of grass root level organizations focusing on drought mitigation	Setting up DMA	1	1	Completed
2		Drought Mitigation Orientation Courses	4	4	Completed
3		NGOs Trainings	4	4	Completed
4		Trainings for Village Development Committees	20	20	Completed
5		Research study on women's role in drought mitigation	1	1	Completed
6		Research study on drought mitigation and health conditions	1	1	Completed
7		Research study on climate resilient rainwater harvesting and farming	1	1	Completed

3.2 Qualitative Assessment of Project Outputs – Field Visit Report

Two project districts were visited to assess the interventions carried out under the project. The consultant participated in one meeting of the Village Development Committee (VDC). The project intervention – *khadin, taanka,* and AHU – were visited to assess the impact. The family profile was also noted to assess the impact of the project interventions on family.

Udat Village

Meeting with VDC Udat

Meeting with community

Udat is a large village in Baap tehsil of District Phalodi (Jodhpur earlier). It is a mixed caste village with Rajputs (4-500), Meghwal (300), Bishnoi (50), Prajapati (15), Suthar (10), and Nai (1-2). The VDC meeting was held in the Kesuram ki Dhani of Prajapati community. There were 10 farmers present in the meeting.

Impact of *Taanka:* The main problem faced by the villagers is lack of water. There is no source of perennial water nearby. The *naadis* do not hold water after monsoons. The villagers have to fetch water from up to 20-25 kms away. In such a situation, the *taankas* built by GRAVIS have been a godsend. The *taankas* can supply water for up to six months, leading to a saving of Rs. 30-40,000. A term used by the participants was that construction and filling up of *taankas* represents half the jamana, meaning that they are safe for six months of the year. This year the *taankas* have overflowed twice in the village.

Impact of *Khadins:* *Khadins* ensure collection of soil, water, and manure resulting into a significant increase in crop output. It was estimated that *khadins* lead to an increased productivity of two quintals per *bigha* (unit of land, one sixth of hectare). One of the villagers who got a *khadin* under the project claimed that he had an output of 20 quintals of *baajra* and 3 quintals of sesame from his *khadin*.

Selecting beneficiaries: The VDC selects beneficiaries on the basis of their need and poverty levels. When questions as to what are the criteria for determining poverty, the indicators cited were condition of house and water storage structures, number of bread earners in the family, presence of Government employees, land holding. They summed up by saying that the villagers fully know what is the status of a household.

Living in *dhaanis:* The participants said that living in *dhaani,* they lose access to all Government schemes. They have not received houses under the PM Awas Yojna.

Impact of climate change, the participants said that the there has been no drought during the last five years. It is not as if it has been perfect rainfall. This year itself, the *baajra* crop withered. However there has been a bumper crop of *guar* to offset the loss of the main food crop. This is noteworthy, as normally every third year is a drought year in the desert region.

Three *taankas* were visited in the village

Taanka of Nirma devi

The *taanka* was built earlier this year before the monsoon. It has overflowed twice. Along with the *taanka,* GRAVIS has started to give a filter for cleaning the water. The bio filter removes biological impurities. It is made of local material.

Nirmala and her taanka

Silt trap: A key intervention introduced by GRAVIS is that of silt trap. A masonry structure is created at the inlet of the *taanka* so that silt gets trapped and does not enter the *taanka.* The silt trap also ensures that the water does not hit the *taanka* walls with force. Outlet pipe removes the extra water coming into *taanka.*

Taanka of Bhanwari devi

The *taanka* of Bahnwari Devi is special because of an innovation introduced by the family. The household has installed a hand pump at the top of the *taanka.* This ensures that the opening lid of the *taanka* is not opened every time there is need to take out water. This ensures cleanliness. It is also a safety feature. The *taankas* being like a small well, there is always risk of children falling inside the *taanka.* In fact, suicide attempts by adults have also been reported.

Bhanwari Devi and her taanka

Villager set up his own AHU

GRAVIS has promoted Arid Horticulture Units as a means to increase food security and nutrition. The AHUs also address the challenge from climate change and frequent droughts. Once grown up, the trees continue to give fruit even in cases of extreme events. In Udat village, a villager has set up his own AHU on the same pattern. A small space has been enclosed. He has planted 20 saplings in his unit. These include lemon, drumstick, *khejri,* and *ber.* He has also grown a sweet potato creeper.

Khadin of Bhura Ram in a village

The *khadin* is 1100 feet long. The water stored in the *khadin* spreads over 14 *bigha* of land. The productivity of the land has multiplied because of the water storage. The production from the *khadin* before and after is shared in the table below

Table 2: Production from *khadin* (in quintals) Kesari Devi

	Bajri	*Moth*	*Guar*
Before	3	3	Not sown
After	Not sown	10	15

As can be seen, grain production has gone up by more than four times – from 6 quintals to 25 quintals.

The total cost incurred was INR 35,000. At the prevailing prices of INR 6,000/ quintal for guar and Rs. 7000/ quintal for moth, the value of the grain output is INR 160,000/- Thus the cost is more than recovered in the first year itself.

Family profile of Kesri Devi : The family has four sons and two daughters. All are grown up and married off. The youngest son stays with Kesri Devi. All the sons and daughters are farmers and wage labourers. Bhura Ram himself used to go to work in brick kilns. He does not go anymore but his sons are going. Three grandsons were present at the *khadin* site. The younger ones Deepchand and Nakhat were studying in class 6 and 1 respectively. However slightly older Vishal around 14 years of age had dropped out. Family has 34 *bigha* of land. It also has 15 goats and two cows.

Arid Horticulture Unit of Ladu Devi

The unit is three years old now. Plants have grown up. When the unit was visited, a flock of bulbuls, a garden bird, was flitting around. The unit has mature trees of *gunda, sahjan,* and *ber.* There is also pomegranate and lemon trees.

Koja Ram has two daughters and one son. The older daughter is married off. The son is studying in college in 2nd year. The younger daughter is studying in class XII. She also received the scholarship given by GRAVIS for female needy students. She plans to undertake the teacher training course. Koja ram has 6 bighas of land.

Khadin of Koja Ram

The water stored in *khadin* is spread over 8 *bigha* (unit of land, one ... of hectare) of land. This is the total land with the family.

Table 3: Production from *khadin* (in quintals) Paru Devi

	Moth	*Guar*	*Sesame*
Before	Not sown	2.5	0.2
After	6	5	Not sown

The grain production went up by four times.

The *khadin* land is shared between two brothers. The younger one Narayan Ram age 22 years is unmarried. He is studying BA 3rd year private. He also works as a security guard in a nearby thermal power plant. He gets INR 10,000/ pm as wages besides PF of INR 1,800/pm.

The elder brother Jagdish has one daughter and one son.

Khadin of Prema Luna Ram

Three brothers share the land on which *khadin* is constructed. One of the brothers has completed BEd and is now appearing for teacher selection tests.

Table 4: Production from *khadin* (in quintals) Prema Ram

	Bajri	*Sesame*	*Guar*
Before	Not sown	Not sown	4
After	12	2	Not sown

The grain production went up by 3.5 times.

Community Seed Bank (CSB): Promotion of tradition agriculture is a critical element of GRAVIS model. GRAVIS promotes setting up of seed banks towards this purpose. The villagers are provided a certain amount of seed from project funds to set up a seed bank. They can borrow seed at the time of sowing. They have to return 125 percent of the amount they borrowed after the harvest. The operation of the CSB was studied in village Udat. It has almost doubled over a three-year period from 2020 to 2023. The number of pitchers storing seed has gone up from six to 12. The amount in seed bank has increased from 150 kg to 278 kg.

Community seed bank

The table below shows the sequence of distribution and collection of seeds

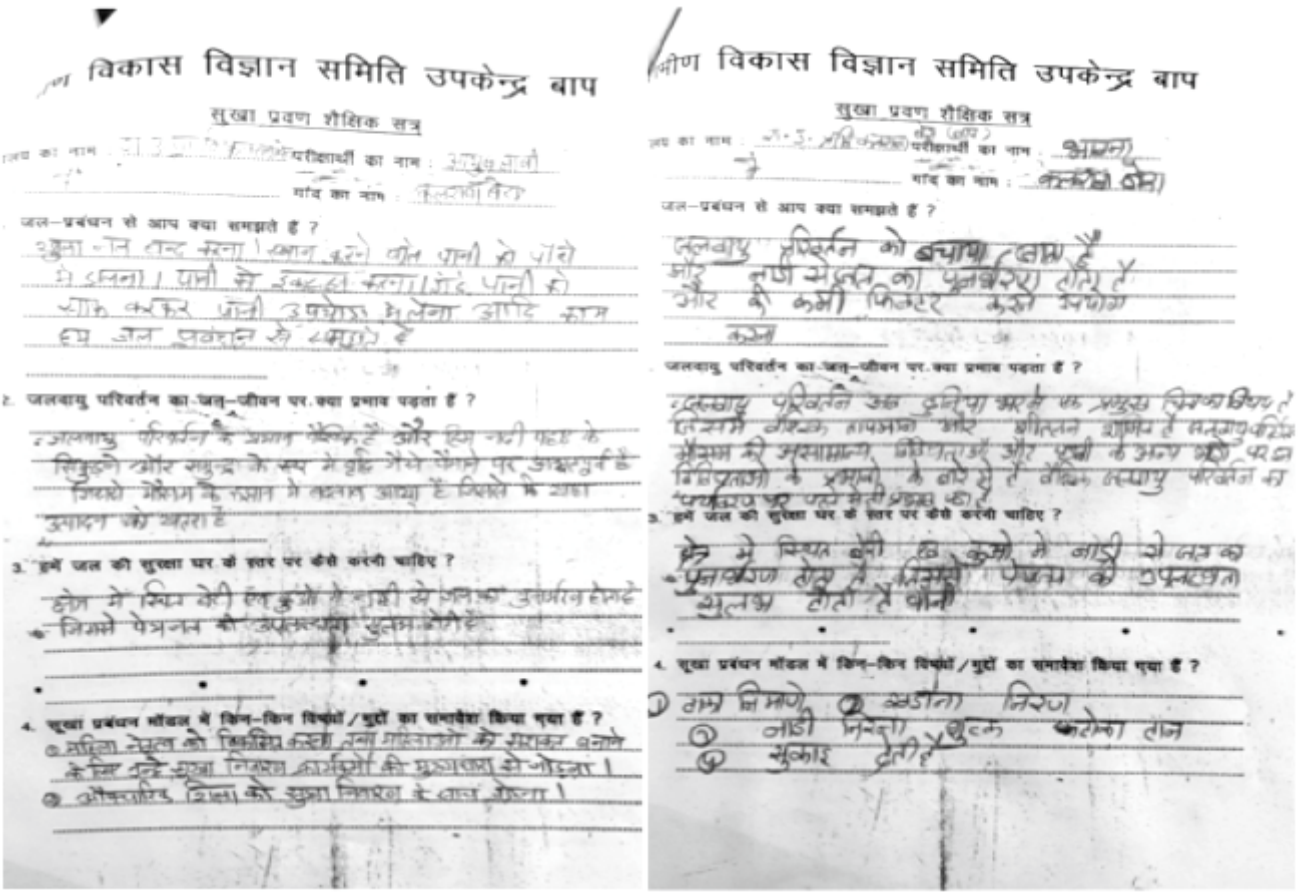
Table 5: Distribution and Collection of Seeds through the Common Seed Bank in Udat village

Crop	*Distribution June 20*	*Collection Jan 21*	*Distribution June 23*
Gwar	40	47	72
Baajra	40	48	76
Moong	25	30	44
Moth	25	30	42
Til	10	13	21
Matira	10	14	23
Total	**150**	**182**	**278**

It can be seen that over a three year period, the seed amount has almost doubled.

Introducing climate change in school curriculum

The project undertakes sessions on climate change with students of secondary schools. After a two-hour session, students are asked to complete a check list that seeks to test their learning. Responses from two students are attached below. The responses show the depth of students' understanding. The students have answered well the impact of climate change and also the steps to tackle it in their local environment.



विकास विज्ञान समिति उपकेन्द्र बाप

सुखा प्रवण शैक्षिक सत्र

परीक्षार्थी का नाम :

गांव का नाम :

जल-प्रबंधन से आप क्या समझते हैं ?

जलवायु परिवर्तन का जल-जीवन पर क्या प्रभाव पड़ता है ?

हमें जल की सुरक्षा घर के स्तर पर कैसे करनी चाहिए ?

सूखा प्रबंधन शौचालय में किन-किन विधियों / युक्तों का समावेश किया गया है ?

Feedback from training participants

Chapter 4

Long term vision:

Tackling climate change: the experts' recommendations and CDM interventions

This section matches the interventions undertaken under the project with the recommendations of the experts. It does so with respect to two data sets. The first of these is the recommendations given under the Rajasthan State Plan on Climate Change, a document prepared for the Government of Rajasthan by an eminent expert body Indian Institute of Technology Bombay. The second data set is from an interview with a domain expert.

Most experts on climate change and the research studies assign critical role to the agency of the communities in tackling climate change.

Section 4.1 on The Rajasthan State Plan on Climate Change lists Measures and Recommendations to reduce agriculture vulnerability. The table below lists the recommendations and the action being taken by the CDM project

Table 6: Recommendation of the Rajasthan State Action Plan on Climate Change and Interventions undertaken under CDM project

Section	Recommendations of RSP	CDM Interventions
4.1.3	Farmers need to be periodically educated on the impacts of climate change on agriculture, efforts that can reduce climate impacts, the threat of climate change on farmers' livelihood, agricultural developments and adaptation strategies. Since human perceptions depend not just on an individual's personality but also on the community, awareness campaigns for farmers at the community level should be encouraged.	Two of the five projects address this recommendation Obj. 3 Link drought mitigation with formal education Obj. 5 Document best practices, research on community perspectives and develop training materials for long-term use and for capacity building of grass root level organizations focusing on drought mitigation The activities carried out under the first objective are 3.1 Drought Education Sessions in schools 3.2 Girl Child Education Scholarships (GCES) 3.3 World Water Day (WWD) events Under the second objective, 5.1 Setting up a Drought Mitigation Academy (DMA) (DMA will be a training facility run by GRAVIS that would help NGOs, researchers, students, local communities and Government Departments to learn the technical aspects of

Section	Recommendations of RSP	CDM Interventions
		drought mitigation and understand the process through exposure to community based projects. With the help of its literature, in-house resources and examples from the past projects, GRAVIS' DMA envision to train about 300 to 600 individual every year.) 5.2 Drought mitigation orientation courses for communities 5.3 Trainings of NGOs on the concepts of drought mitigation 5.4 Trainigs for Village Development Commitees 5.5 Research on women's roles in drought mitigation 5.6 Research on the link between drought mitogation and improving health conditions 5.7 Research on climate resilient rainwater harvesting and rainfed farming 5.8 Documenting best practices 5.9 Baseline survey
4.1.4 A	Diversification of crops can shield farmers against the vagaries of nature by giving them a wider choice. Farmers can opt for value-added crops and new crop species/varieties. They can rotate crops based on water availability to bring down the possible risk of crop failure. For example, where water is scarce, farmers should switch from water-intensive crops such as wheat and barley to less water-intensive crops such as millets, soybean and legumes. The focus should be on the districts in high vulnerability clusters and the districts of Jaisalmer, Barmer, and Rajasmand, which have the least diversification of crops in the state of Rajasthan.	As shared in the main report, mixed cropping is already the norm in the project area. Unfortunately, this has been getting replaced with mono cropping under irrigated agriculture. The CDM project has sought to revive and continue the practice of mixed cropping. It started seed banks in the project villages. As documented during the field study, the seed banks have almost doubled in size during the project duration.

Section	Recommendations of RSP	CDM Interventions
4.1.4 B	Indiscriminate use of groundwater for water-intensive crops will lead to rapid depletion of underground water. Sensitising farmers on less water-intensive crops and training them on arid horticulture will help mitigate the water crisis. Farmers should sow crops consuming less irrigation water and join the efforts for water conservation. Krishi Vigyan Kendra (KVK), which periodically tests soil and informs the farmers about feasible crops, also needs to educate and train farmers on arid horticulture	Promotion of traditional cropping system is built into project activities as shared in the previous column. The CDM project has set up a large number of Arid Horticulture Units (AHU). As documented in the field visit report, the community is also beginning to set up AHUs on it own now.
4.1.4 C	Farmers should be encouraged to adopt rainwater harvesting to collect run-off rainwater for use in crop irrigation, which will make farming more sustainable. Construction of rainwater tanks at the household level and construction of ponds or tanks at the community or village level should be promoted. Optimum use of water resources will deliver positive results in the future. Provision for rainwater harvesting should be made essential for digging tube wells.	The very first project objective 'Understand climate change impact on desert communities and accordingly implement innovative solutions on climate smart agriculture and climate resilient water harvesting' promotes rainwater harvesting. The various activities undertaken under this objective include 1.1 Construction of drinking water storage tanks *(taankas)* 1.2 Construction of farming dykes *(khadins)* 1.3 Renovation of ponds 1.4 Setting up pastures 1.5 Technical trainings on rainwater harvesting 1.6 Technical trainings on rainfed farming 1.7 Seed banks
4.1.5 B	Better drought management systems: Measures such as restoring traditional rainwater harvesting systems in the state, rooftop rainwater harvesting, recycling wastewater, timely response for drought-prone population, allocation of irrigation water in drought-prone areas, and engaging communities in management will help the state manage the droughts.	This the overall project goal, to demonstrate a Community Based model of Drought Management.

Interview with Dr. D Kumar, who retired from CAZRI: The consultant interviewed Dr D Kumar of Central Arid Zone Research Institute on the impact of climate change on agriculture in desert regions and mitigation of the same on 8th November. Dr Kumar was All India Coordinator for Arid Legumes. The excerpts from the interview are reproduced below

1. The features of the climate change taking place have been documented well – rise in temperature, ice melt, extreme weather events, change in rainfall patterns. However, there is little work on how to address its impact at ground level.
2. Untimely rains lead to untimely sowing giving rise to new pests and pathogens that were not present earlier
3. Biotic and abiotic stress – both need to be managed
4. Environment does not repeat itself, it revolves
5. Increase in rainfall needs to be managed at farm level. Creating proper drainage systems, farm ponds to store water
6. Wind breaks in areas of high velocity
7. Soil strengthening
8. Poly houses are one response to climate change. However, these need to be designed better.
9. Muti cropping / inter cropping is the best response to climate change, however farmers are increasingly resorting to monoculture.
10. The farms used to have trees like *khejdi* and *kumat.* However, these are not being grown now. The trees we see in fields are from old times.
11. There is need to go back to the older traditional farming practices.
12. Climate change needs to become a part of the curriculum

Points number 1 to 4 relate to climate change and its impact while the remaining points focus on how address climate change. In the section below, recommendation of Dr Kumar are matched against activities undertaken under the CDM project. It can be seen the recommended activities are mostly included in the CDM project.

Recommendation of SMS	***CDM Intervention***
Increase in rainfall needs to be managed at farm level. Creating proper drainage systems, farm ponds to store water	The project is undertaking rainwater harvesting at the farm level through construction of *khadins* and at the household level through construction of *taankas.*
Muti cropping / inter cropping is the best response to climate change, however farmers are increasingly resorting to monoculture	The project encourages the traditional mixed cropping practices through promotion of seed banks.
The farms used to have trees like *khejdi* and *kumat*. However, these are not being grown now. The trees we see in fields are from old times	Traditional fruit trees are being planted in the AHUs while the other species are being planted in pasture land developed under the project.
There is need to go back to the older traditional farming practices	The project supports traditional farming practices.
Climate change needs to become a part of the curriculum	This is a project activity. There is provision of sessions on climate change in the schools in project area.

Chapter 5
Global Policy on Climate Change: The Road Forward

Droughts, floods, storms, heat waves - the effects of climate change are already visible. Its negative consequences hit developing countries particularly hard. International climate policy therefore faces a twofold challenge: on the one hand, it must promote climate protection by reducing greenhouse gas emissions; on the other hand, it must help people and ecosystems to adapt to the effects of climate change.

The Paris Climate Agreement of 2015 is a turning point in international climate and development policy. It is the first legally binding agreement with climate policy commitments for all signatory states. The agreement provides for global warming to be limited to well below two degrees Celsius, if possible, even to 1.5 degrees (based on pre-industrial levels). All 197 Parties to the Paris Accord have undertaken to submit National Determined Contributions (NDCs), which are also regularly reviewed and updated (GIZ 2023).

The Union Cabinet chaired by the Prime Minister Shri Narendra Modi, has approved India's updated Nationally Determined Contribution (NDC) to be communicated to the United Nations Framework Convention on Climate Change (UNFCCC).

As per the updated NDC, India now stands committed to reduce Emissions Intensity of its GDP by 45 percent by 2030, from 2005 level and achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030. The approval, also takes forward the Hon'ble Prime Minister's vision of sustainable lifestyles and climate justice to protect the poor and vulnerable from adverse impacts of climate change. The updated NDC reads "To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation, including through a mass movement for 'LIFE'– 'Lifestyle for Environment' as a key to combating climate change". The decision on enhanced NDCs demonstrates India's commitment at the highest level for decoupling of economic growth from greenhouse gas emissions.

India's updated NDC has been prepared after carefully considering our national circumstances and the principle of common but differentiated responsibilities and respective capabilities (CBDR-RC). India's updated NDC also reaffirms its commitment to work towards a low carbon emission pathway, while simultaneously endeavouring to achieve sustainable development goals.

Recognizing that lifestyle has a big role in climate change, the Hon'ble Prime Minister of India, at COP 26, proposed a 'One-Word Movement', to the global community. This one word is LIFE…L, I, F, E, i.e. Lifestyle For Environment. The vision of LIFE is to live a lifestyle that is in tune with our planet and does not harm it. India's updated NDC also captures this citizen centric approach to combat climate change.

The mantra of LIFE- Lifestyle for Environment to combat climate change was also shared in COP 26. It was stated that Lifestyle for Environment has to be taken forward as a campaign to make it a mass movement of

Environment Conscious Lifestyles. The message conveyed by India was that the world needs mindful and deliberate utilization, instead of mindless and destructive consumption.

1. To put forward and further propagate a healthy and sustainable way of living based on traditions and values of conservation and moderation, including through a mass movement for 'LIFE'– 'Lifestyle for Environment' as a key to combating climate change.
2. To adopt a climate friendly and a cleaner path than the one followed hitherto by others at corresponding level of economic development.
3. To reduce Emissions Intensity of its GDP by 45 percent by 2030, from 2005 level.
4. To achieve about 50 percent cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030, with the help of transfer of technology and low-cost international finance including from Green Climate Fund (GCF).
5. To create an additional carbon sink of 2.5 to 3 billion tonnes of CO2 equivalent through additional forest and tree cover by 2030.
6. To better adapt to climate change by enhancing investments in development programmes in sectors vulnerable to climate change, particularly agriculture, water resources, Himalayan region, coastal regions, health and disaster management.
7. To mobilize domestic and new & additional funds from developed countries to implement the above mitigation and adaptation actions in view of the resource required and the resource gap.
8. To build capacities, create domestic framework and international architecture for quick diffusion of cutting-edge climate technology in India and for joint collaborative R&D for such future technologies.

Analysis of the global strategy and the Indian NDC shows that while the first challenge of reducing global emission is getting focus, the second challenge to help people and ecosystems adopt to global change is not getting equal attention. This is further corroborated by the Adaptation Gap Report brought out by UNEP in 2023 (AGR 2023).

The recently released Adaptation Gap Report by UNEP looks at progress in planning, financing and implementing adaptation actions. The report finds that the adaptation finance needs of developing countries are 10-18 times as big as international public finance flows. This is over 50 per cent higher than the previous range estimate.

The modelled costs of adaptation in developing countries are estimated at US$215 billion per year this decade. The adaptation finance needed to implement domestic adaptation priorities is estimated at US$387 billion per year.

Gender equality and social inclusion are inadequately included in adaptation finance needs and flows. There is global recognition that climate change can exacerbate inequality in multiple dimensions of social identity, including gender, indigeneity, age, ethnicity, migrant status or disability. At the same time, adaptation activities considering gender and other social identities are linked with higher effectiveness in achieving their objectives. The AGR 2023 has analysed the integration of gender equality and social

inclusion in costed NDCs and NAPs. It finds that only 20 per cent of these plans have a dedicated budget for such activities, and that the amount allocated is generally low, averaging 2 per cent.

The Recommendations

Studies on impact of climate change on local eco systems: While there is an abundance of research on global impacts of climate change, studies on local impact are not available. There is need for such studies so that local communities become more aware of the phenomenon and get ready to adapt their livelihood systems and lifestyles.

More support for adaptation measures: There is need to understand the impact of global change on different ecosystems, and especially those that are vulnerable. This needs to be followed up with preparing people for the changes and introducing suitable changes in production systems that are aligned with impending changes. The specific changes in the context of desert regions have been discussed in detail in Chapter 4.

Inclusion of gender equality and social inclusion in climate change mitigation: It is highly likely that the climate change will affect the women and the marginalized sections of society more. There inclusion of gender equality and social inclusion should be mandatory when planning climate change mitigation strategies.

Involving local communities in adaptation: GRAVIS has been working to adapt local communities to impact of climate change. There is need to continue this approach and mobilize more resources for this.

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List of Abbreviations

AGR: Adaptation Gap Report

CDM: Community led Drought Mitigation

GRAVIS: Gramin Vikas Vigyan Samiti

KVK: Krishi Vigyan Kendra

NDC: Nationally Determined Contribution

RSAPCC: Rajasthan State Action Plan on Climate Change

UNEP: United Nations Environment Program

VDC: Village Development Committee

NOTES

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GRAVIS is a leading Non-Governmental Organization working in rural India in the States of Rajasthan, Uttarakhand, and the Bundelkhand region of Uttar Pradesh. Since its inception in 1983. GRAVIS has worked in over 2,000 villages reaching a population of over 2 million and has established over 4,000 Community Based Organizations (CBOs). GRAVIS believes in participatory community development that blends traditional knowledge and modern sciences and promotes equality.

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