Kadavakurichi watershed, Climate Proofing Project Dindigul District, Tamil Nadu Funded by NABARD under WDF

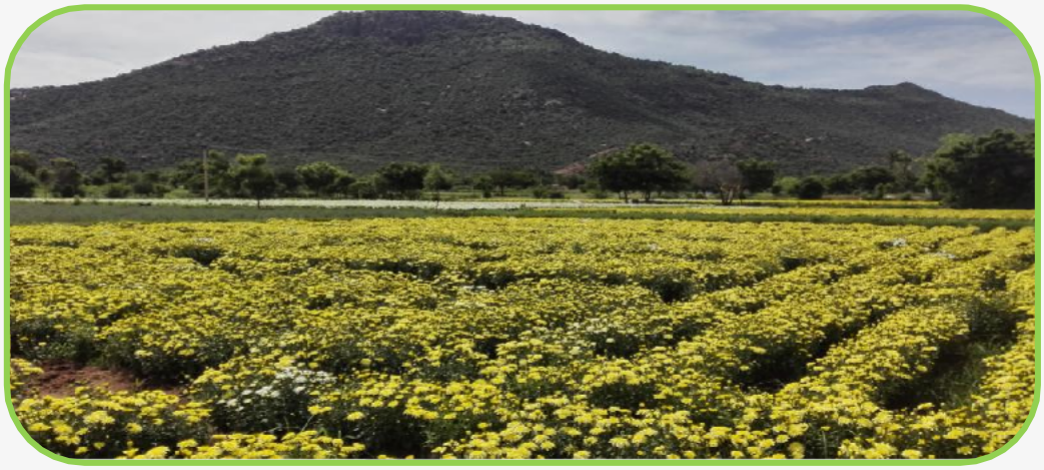
PROJECT COMPLETION REPORT

Submitted to NABARD, Chennai

Submitted by

Centre for Improved Rural Health and Environmental Protection (CIRHEP)

D.No: 2/198.1, Baniyan Tree, Muniyandi Kovil near, Veelinayakenpatti, Nilakottai-624208
Dindigul District
Tamil Nadu



This report has been produced for NABARD.

This report is Project compilation of information from the field level observations to assess the impact of various climate resilient watershed development activities undertaken based on climate proofing analysis in the Kadavakurichi watershed in Dindigul District, Tamil Nadu

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Executive summary

Kadavakurichi is the driest watershed situated around 4 Km Southwest to Nilakottai town, taluk in Nilakottai block of Dindigul district. The average annual rainfall is 846.61 mm. The people residing in this area are mainly small and marginal farmers belonging to backward and scheduled caste. Majority of the people are depending on agriculture. The activities of the watershed project have been implemented successfully through Kadavakurichi Village watershed committee in mobilizing the communities of Kadavakurichi on sustainable natural resource management. Watershed activities including physical treatment measures, formation and strengthening of Village Watershed Committee (VWC), SHGs, Income Generating Activities and women's empowerment are the key processes facilitated during the climate proofing project .

On the basis of PRA and the suggestions on adaptation methods and strategies were developed by Department of Agro-Climate Research Centre of Tamil Nadu Agricultural University, Coimbatore for incorporation in the net plan such as Soil and Water conservation methods, measures to increase water use efficiency, ways to increase the farm income and minimise risk in crop production. It was also suggested that to provide mobile linked ICT, value addition and marketing of agricultural produces will go a long way in better adaptation and resilience of targeted communities to changes in climatic and non-climate variability. Activities such as Sunken pond, Fodder trees for gully stabilisation, Backyard fruit plants, Bund planting, Agro Horticulture, Well Recharge Pit (WRP), Soil testing and issuing soil health card , Summer ploughing, Deep Tillage, Green manure cultivation , Vermi Compost , Tank silt application, Bio fertilizer, Bio control agents, Egg cards , Pheromone traps , Azolla demo unit , Honey bee keeping , Alternate verities – demo, Alternate crops – demo, Intercropping, Crop rotation, Seed treatment, Kitchen Garden/Nutritional garden, Poultry unit, Agriculture tool bank for SHG, Weather based Agro Advisory Services, Crop insurance, Farmers trainings, Exposure visit , Posters and Pamphlet on climate change Adaptation, Audio visual tools - short films, Staff training and Watershed level knowledge management are implemented with the financial support of NABARD .

Significant improvements have been seen in the soil and water conservation aspects in the watershed resulting in better capture of rainfall, ground water recharge and increased water availability for drinking and irrigation and improved soil fertility contributing to increased crop production. The net sown area has increased in the watershed and there is more availability of fodder for livestock. Communities have received gainful employment under

the project especially during the lean months of the year. Apart from providing employment and income, provided multiple environmental services such as increased ground water recharge, water percolation, enhanced water storage in tanks, increased soil fertility, soil moisture, crop yield, fodder availability and overall income of the family, decreased ambient temperature, reclamation of degraded lands and Carbon sequestration.

The activities have the potential to provide guaranteed benefits such as desilting of water bodies accompanied by silt removal and application to crop fields, land development leading to land levelling and cropping, fodder trees for gully stabilization (as a drought proofing activity) with appropriate species choice and construction of Sunken pond.

Women SHG members are more active and have accessed institutional finance for undertaking income generation activities and entrepreneurship development. Agricultural production and biomass have increased with enhanced incomes and savings from purchase of fertilizers & pesticides, fodder etc. Social cohesion aspects have improved including the gender relations between women and men, girls and boys. Women are now more vocal and participate in meetings and are involved in the decision making processes at households and community level. Women discuss specific issues of improved water, sanitation and personal hygiene and other social issues impacting their lives and livelihoods. Women now collectively help other women and families in distress. Distress sale of cattle has reduced in the village due to availability of increased biomass and access to institutional finance. Targeting aspects have been consciously addressed for inclusion of the poor and most vulnerable individuals and families under the project and supporting them with specific project activities based on their specific requirements and vulnerabilities. Such individuals and households have also been linked and availing financial support from nationalized banks. The positive impacts of the watershed treatment and community mobilization activities will be realized during the next cropping season and in the coming years.

As a result the social, economical and livelihood situations such as increase the household income, women empowerment, changes tiled houses into concrete houses, owning two wheelers, fridges, washing machines etc, are some of the improvements obtained from the increased income by accessing water for drinking and agricultural activities, fodder and fuel. It also reduced the drudgery of the women in the watershed area and made them to concentrate with some other income generating activities. The community people in the watershed had expressed their views that these mechanisms have been facilitating climate change adaptation practices such as soil and water conservation, fodder trees for gully stabilization , Bund planting, agro horticulture, They delivered their gratitude to NABARD, Tamil Nadu Agricultural University and CIRHEP for the implementation of soil and water conservation, income generating and other environmental up gradation activities.

SECTION 1

Introduction

Background

Farming is a gamble with nature. The impact of climate change is expected to be more severe in poor, geographically vulnerable regions with largely agrarian economies. Adaptation to climate change in India requires integrated solutions that simultaneously address livelihood improvements, sustainability, as well as growth issues. Proactive measures for adaptation to climate variability and change can substantially reduce many of the adverse impacts, and thus contribute to livelihood security of the vulnerable rural population. While climate change will affect the nation's economy as a whole, its impact will be more severely felt by the poor who also have the least adaptive capacity. Recognizing this, the National Action Plan on Climate Change (NAPCC) clearly outlines its first principle as "protecting the poor and vulnerable sections of the society through inclusive and sustainable development strategy, sensitive to climate change".

Climate Proofing of rural development programmes is one approaches followed by NABARD to integrate adaptation to climate change into planning, supports NABARD to assess their Watershed Development Fund in regards to observed and projected climatic changes. The approach is being Kadavakurichi watershed in Dindigul district, Tamil Nadu viz., Kadavakurichi watershed, which has more than 70 per cent of its workforce, is in agriculture and climate change is expected to lower yields in key crops that would have implications on the livelihoods of the people.

Through this Climate Proofing study, issues of climate change were incorporated for identification, prioritization and implementation of options to develop more resilient watershed programme to the current and future challenges and opportunities presented by climate change. The interventions seek to address the challenges of low agricultural productivity, increasing income of the rural poor people and minimizes the environmental degradation problems that causes of resource degradation such as, loss of soils through erosion, declining soil fertility, loss of vegetative cover and increasing vulnerability to drought particularly in the farming zones. Climate proofing interventions are jointly implemented through the Village Watershed Committee (VWC) and Project Facilitating Agency- Centre for Improved Rural Health and Environment Protection (CIRHEP) along with Community watershed management plans to ensure better management and development of the natural resources to achieve the goal of household food security.

The current assignment was undertaken to evaluate the impact of climate proofed watershed activities on the water, agriculture, socioeconomic conditions and livelihood security of the people in the study watershed.

Location of the project area

Location of the proposed watershed

Watershed name	Taluk	District	State	Latitude	Longitude	Altitude
Kadavakurichi	Nilakottai	Dindigul	Tamil Nadu	10.14	77.81	245

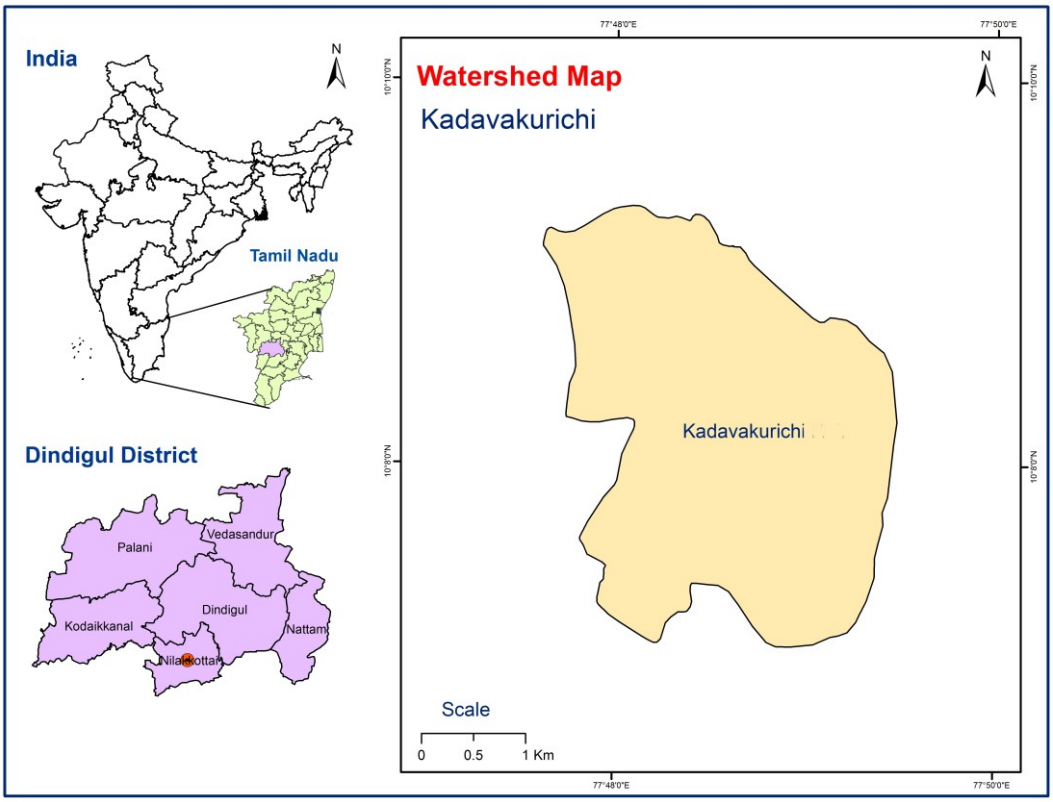


Figure 1 Location map of study watersheds

Kadavakurichi watershed consists of Six hamlet villages namely Veelinayakenpatti, Pappinayakenpatti,Jeyanayakenpatti, Mutharayarnagar,Kamatchipuram and Duraichamipuram. The total area of Kadavakurichi watershed is 837.27 ha. The number of households in Kadavakurichi watershed is 523 and the total population is 2980. The literacy level is 60 per cent.

Current Situation:

3 Monsoon failure
4 Drought
5 Temperature extremes

1. Monsoon Failure

a. Drinking Water scarcity
b. Ground water level reduced.
c. Crop failure.
d. Decreased employment – seasonal migration
e. Reduced buying capacity.
f. CBO members could not involve the watershed activities.
g. Lack of Animal feed – Selling animals for less price.
h. Less Productivity and Cultivation.
i. Lack of high nutrition food for people.
j. Lack of awareness about latest irrigation technologies.
k. Less common responsibility to people

2. **Temperature Extremes**
    a. Evaporates the water
    b. Animal affected by disease.
    c. Less soil moisture

Risk Event	Consequence	Likelihood probability/ frequency of occurrence	Risk
Droughts	Trees dies, Shortage of Food, Reduction in crop yields/ production	Almost every year	High
Monsoon Failure	Scarcity of fodder, negative effect in crop yield.	Once in 3 – 4 years	High
Intermittent dry spell	Less Productivity	Frequent – almost every alternate year	Medium
Temperature Extremes	Increased evapo-transpiration	Once in 5 years	Medium
Flood	Heavy Soil erosion, Damage of structures in water bodies which constructed earlier, Damage of houses, Cattles died.	Rare	Low

1. RAINFALL

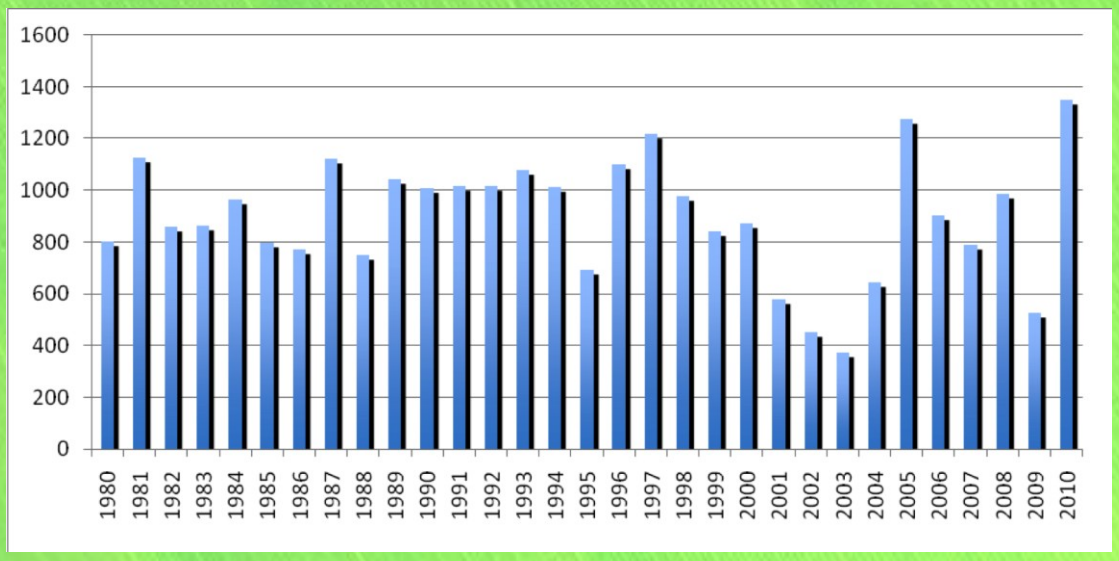
For understanding the current climate, daily rainfall, maximum and minimum temperatures data were obtained from India Meteorological Department for the period from 1980 - 2010.

A. Annual rainfall

Table 1: Annual rainfall category

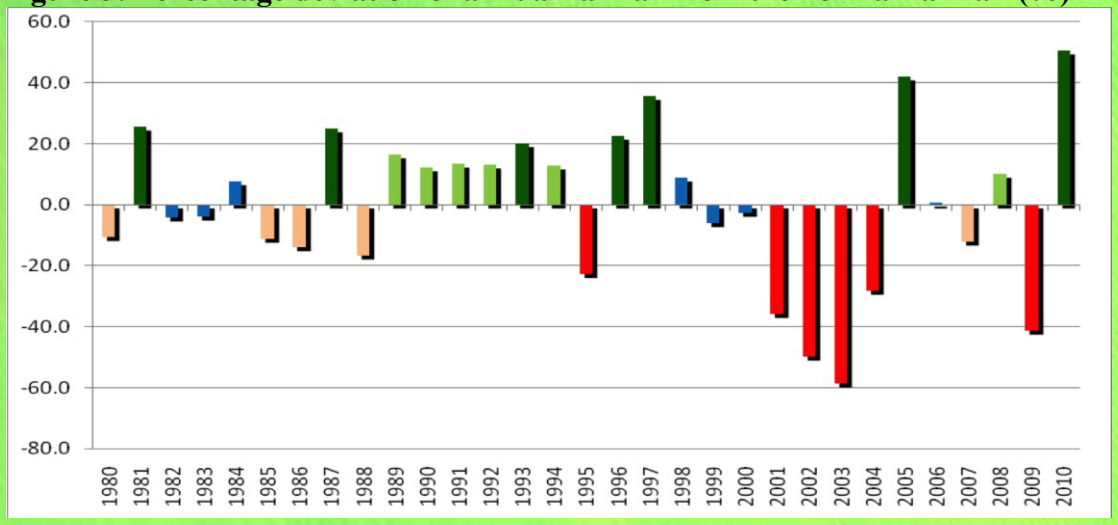
Year	Annual Rainfall (mm)	% Deviation from Normal	Category	Year	Annual Rainfall (mm)	% Deviation from Normal	Category
1980	803.4	-10.4	Below Normal	1996	1099.7	22.6	Excess
1981	1127.9	25.8	Excess	1997	1217.5	35.8	Excess
1982	859.1	-4.2	Normal	1998	976.9	8.9	Normal
1983	861.7	-3.9	Normal	1999	842.4	-6.1	Normal
1984	964.5	7.6	Normal	2000	874.1	-2.5	Normal
1985	796.6	-11.2	Below Normal	2001	576.3	-35.7	Deficit
1986	772.5	-13.9	Below Normal	2002	449.3	-49.9	Deficit
1987	1121	25.0	Excess	2003	371.2	-58.6	Deficit
1988	747.2	-16.7	Below Normal	2004	643.1	-28.3	Deficit
1989	1043.6	16.4	Above Normal	2005	1274.3	42.1	Excess
1990	1007.6	12.4	Above Normal	2006	901.7	0.6	Normal
1991	1017.9	13.5	Above Normal	2007	788.5	-12.1	Below Normal
1992	1014.9	13.2	Above Normal	2008	987.5	10.1	Above Normal
1993	1076.6	20.1	Excess	2009	527.4	-41.2	Deficit
1994	1011.8	12.8	Above Normal	2010	1350.2	50.6	Excess
1995	693.4	-22.7	Deficit				

Figure 2: Annual rainfall (mm)



Based on the India Meteorological Department (IMD) classification, if the rainfall received in that particular year is within ± 19% of the LPA, that year is called as a normal rainfall year, <-19% to -59% of the LPA is deficit rainfall year, <-59% of LPA is grouped under scanty rainfall year. On the other hand, if the rainfall is >+19% to +59% of LPA, it is excess rain fall year and >+59% LPA is termed as wet year. In our current analysis, normal rainfall category has been further classified as -19 to -10.1% of LPA as Below normal rainfall year, -10 to +10% of LPA as normal rainfall year and +10.1 to +19% of LPA as above normal rainfall years.

Figure 3: Percentage deviation of annual rainfall from the normal rainfall (%)



Deficit rainfall	Below Normal rainfall	Normal rainfall	Above normal rainfall	Excess rainfall
- 19.1 to -59% of LPA	-19 to -10.1% of LPA	-10 to +10% of LPA	+10.1 to +19% of LPA	> +19.1 % of LPA
6 years	5 Years	7 years	6 years	7 years

B. Seasonal rainfall

Distribution of mean rainfall during different months is presented in Figure 4.

Figure 4: Mean seasonal rainfall (mm)

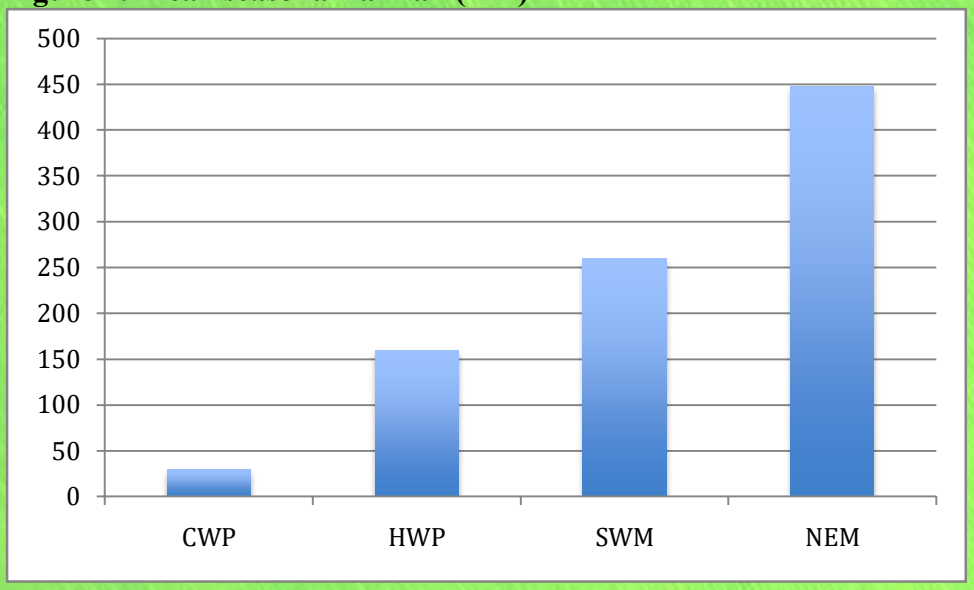
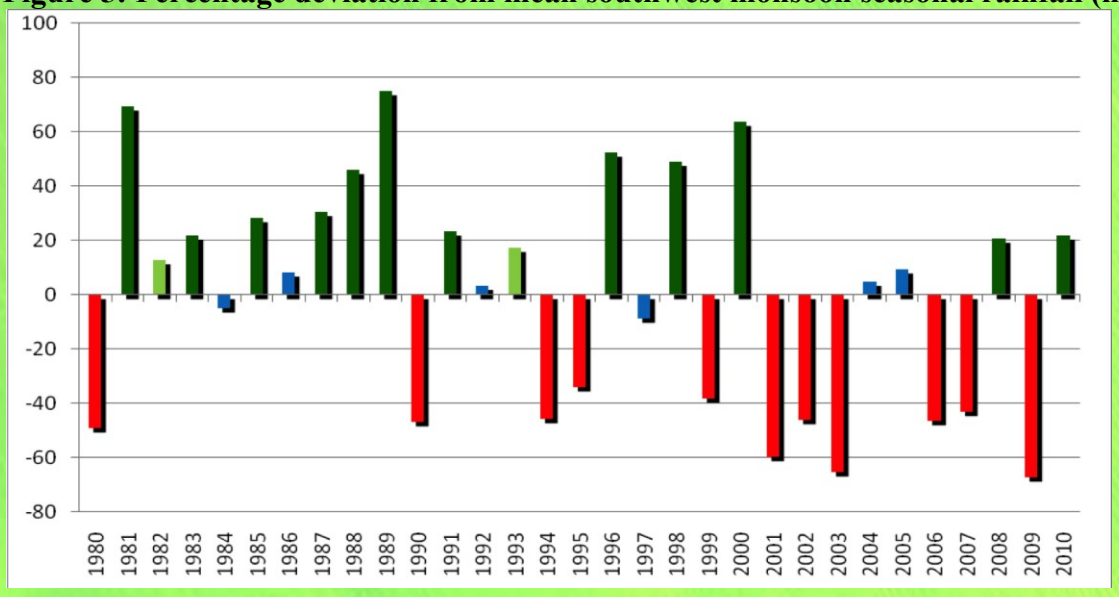
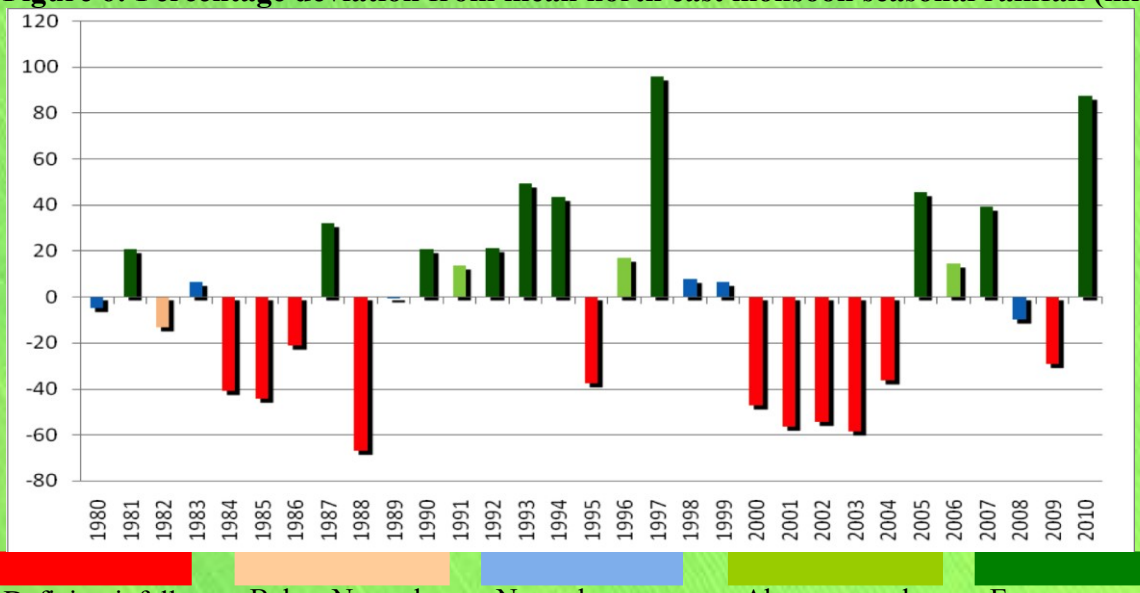


Figure 5: Percentage deviation from mean southwest monsoon seasonal rainfall (mm)



Deficit rainfall	Below Normal rainfall	Normal rainfall	Above normal rainfall	Excess rainfall
- 19.1 to -59% of LPA	-19 to -10.1% of LPA	-10 to +10% of LPA	+10.1 to +19% of LPA	> +19.1 % of LPA
11 years	0 Years	6 years	2 years	12 years

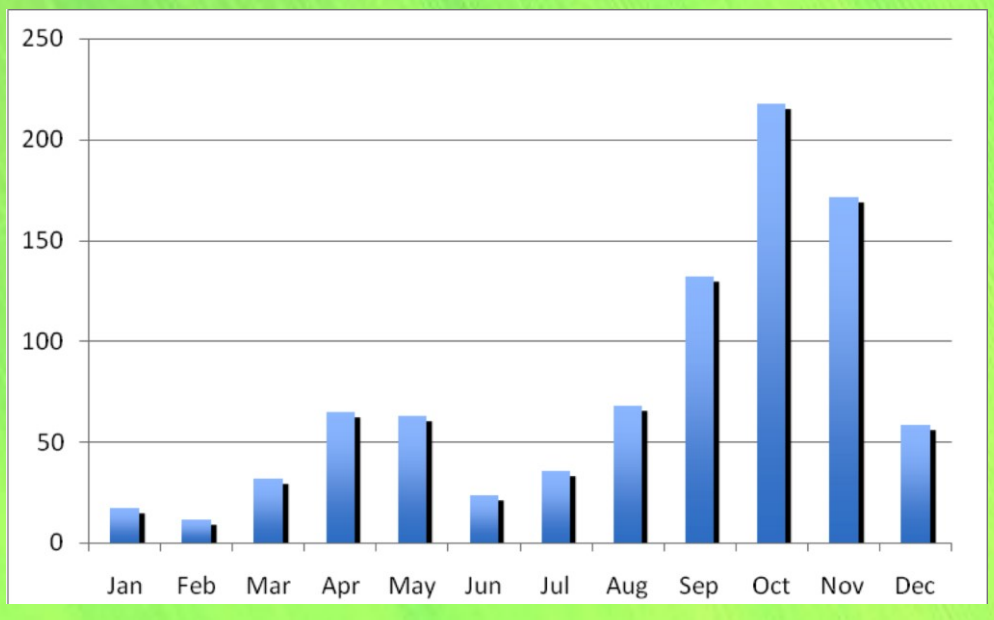
Figure 6: Percentage deviation from mean north east monsoon seasonal rainfall (mm)



Deficit rainfall	Below Normal rainfall	Normal rainfall	Above normal rainfall	Excess rainfall
- 19.1 to -59% of LPA	-19 to -10.1% of LPA	-10 to +10% of LPA	+10.1 to +19% of LPA	> +19.1 % of LPA
11 years	1 Years	6 years	3years	10 years

C. Monthly rainfall

Figure 7: Mean monthly rainfall (mm)



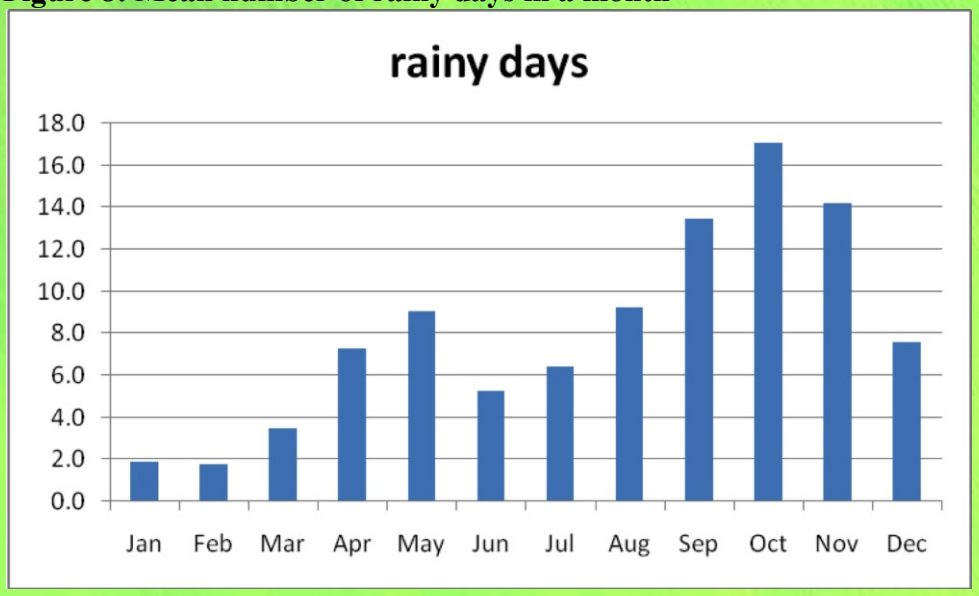
D. Shift in Rainfall amount

Table 2: Monthly rainfall of Watershed (mm)

Rainfall (mm)	Historical 1980-2010	1980 - 1990	1991-2000	2001-2010	% change in rainfall over the period		
	A	B	C	D	B to A	C to A	D to A
Annual	896.8	909.8	995.9	739.3	1.4	11.1	-17.6
Winter	29.3	34.0	35.3	21.2	16.1	20.6	-27.5
Summer	159.8	166.1	153.8	156.6	3.9	-3.8	-2.0
SWM	259.6	321.2	252.2	199.8	23.7	-2.8	-23.1
NEM	448.0	388.5	554.6	361.8	-13.3	23.8	-19.2
Jan	17.4	20.5	27.8	5.4	17.9	59.7	-69.1
Feb	11.9	13.4	7.5	15.8	13.4	-36.9	33.5
Mar	31.7	42.8	9.9	45.6	35.1	-68.9	43.8
Apr	65.1	62.7	71.7	65.5	-3.7	10.1	0.7
May	63.1	60.6	72.3	45.5	-4.0	14.6	-27.9
Jun	23.8	29.0	20.1	20.2	21.9	-15.3	-15.2
July	35.7	53.3	33.0	20.7	49.1	-7.6	-42.0
Aug	68.0	61.5	78.8	65.7	-9.5	15.9	-3.3
Sep	132.1	177.4	120.3	93.1	34.3	-9.0	-29.5
Oct	217.8	197.3	272.9	175.9	-9.4	25.3	-19.2
Nov	171.5	131.9	216.5	136.3	-23.1	26.2	-20.6
Dec	58.8	59.3	65.1	49.7	1.0	10.8	-15.4

E. Rainy Days

Figure 8: Mean number of rainy days in a month



F. Shift in Rainy days

Table 2: Number of rainy days

Rainy days	Historical 1980-2010	1980 - 1990	1991-2000	2001-2010	% change in rainfall over the period		
	A	B	C	D	B to A	C to A	D to A
Annual	96.8	97.9	100.5	91.9	1.1	3.8	-5.1
Winter	3.7	4.6	3.0	3.6	25.1	-18.4	-2.1
Summer	19.9	19.2	20.0	21.0	-3.4	0.6	5.7
SWM	34.4	35.8	36.0	31.8	4.0	4.6	-7.6
NEM	38.9	38.3	41.5	35.5	-1.5	6.8	-8.7
Jan	1.9	2.5	1.5	1.7	31.4	-21.2	-10.7
Feb	1.8	2.1	1.5	1.9	18.4	-15.5	7.1
Mar	3.5	3.9	2.5	4.5	10.9	-28.9	28.0
Apr	7.3	6.2	7.8	7.9	-15.0	7.0	8.4
May	9.1	9.1	9.7	8.6	0.4	7.0	-5.1
Jun	5.3	4.0	6.5	5.3	-23.9	23.6	0.8
July	6.5	7.9	5.3	6.1	22.4	-17.9	-5.5
Aug	9.3	9.3	9.8	8.8	0.5	5.9	-4.9
Sep	13.5	14.6	14.4	11.6	8.5	7.1	-13.8
Oct	17.1	17.9	17.9	15.6	4.9	4.9	-8.6
Nov	14.2	12.3	15.5	14.0	-13.3	9.2	-1.4
Dec	7.6	8.1	8.1	5.9	6.4	6.4	-22.5

G. Extreme event analysis - Rainfall

Table 3: Number of extreme events in rainfall

Rainfall (mm)	Historical 1980-2010	1980 - 1990	1991-2000	2001-2010	% change in rainfall over the period		
	A	B	C	D	B to A	C to A	D to A
No. of days with > 25 mm rainfall							
Annual	185.7	150.8	221.7	167.0	-18.8	19.4	-10.1
Winter	7.2	7.0	14.1	1.3	-3.4	95.1	-81.8
Summer	30.6	30.2	23.1	33.5	-1.6	-24.5	9.3
SWM	38.0	46.2	40.9	27.6	21.6	7.6	-27.3
NEM	109.8	67.5	143.5	104.6	-38.6	30.6	-4.8
No. of days with >50 mm rainfall							
Annual	54.1	34.4	65.4	58.4	-36.4	20.9	7.9
Winter	4.2	4.4	8.6	0.0	5.5	104.5	-100.0
Summer	10.2	11.9	4.9	12.5	16.8	-51.9	22.9
SWM	6.9	6.9	8.0	6.5	-0.1	15.7	-5.6
NEM	32.9	11.2	44.0	39.4	-65.8	33.8	19.9
No. of days with >75 mm rainfall							
Annual	16.0	8.0	16.2	21.5	-49.9	1.3	34.3
Winter	1.8	1.9	3.6	0.0	8.4	101.6	-100.0
Summer	3.7	4.1	0.0	7.3	11.6	-98.9	97.3
SWM	1.0	1.2	0.6	1.2	20.2	-35.4	25.2
NEM	9.5	0.8	12.0	13.0	-91.8	25.3	35.7

2. TEMPERATURE

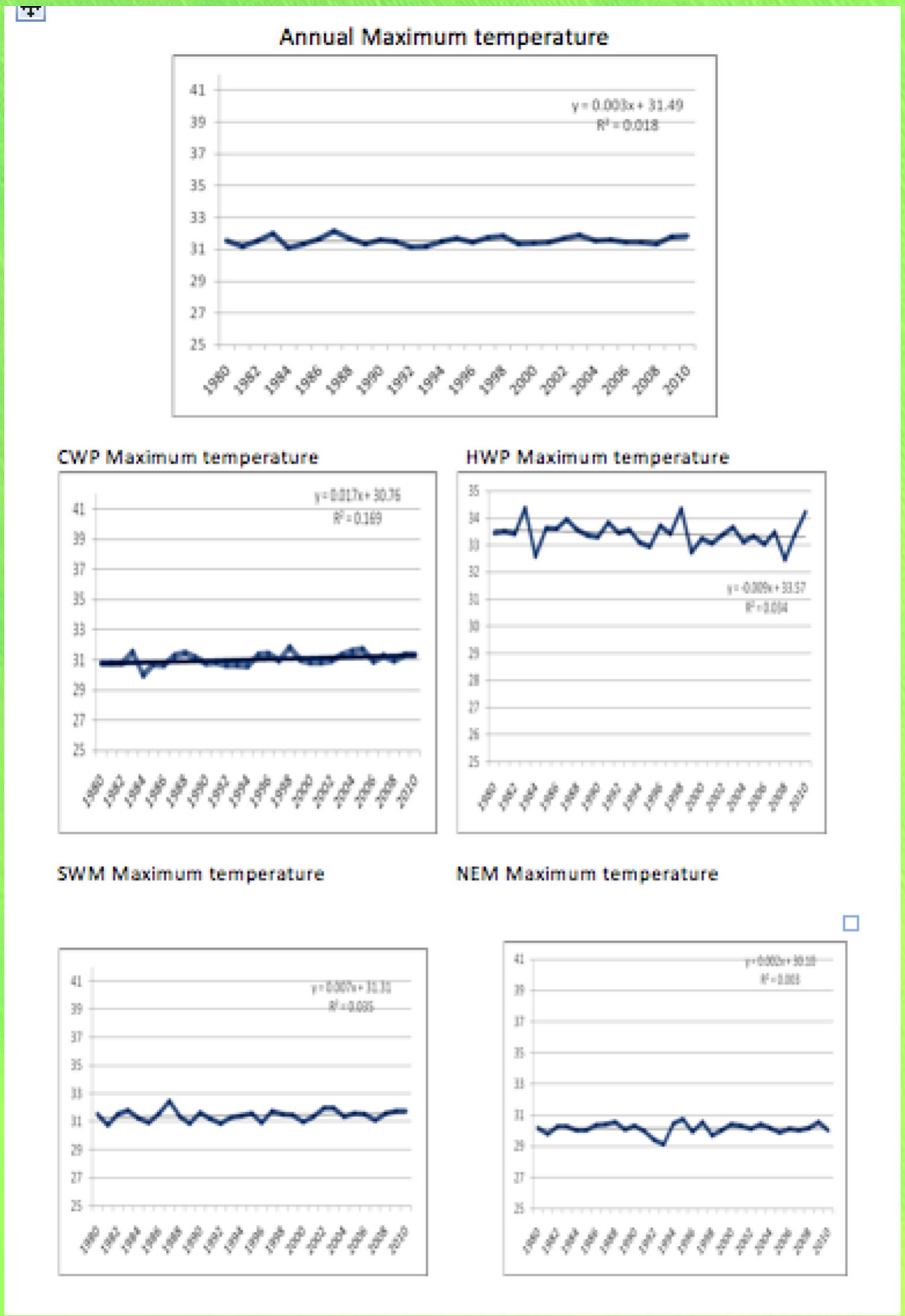
Table 4: Mean Maximum temperature in ^{0}C

Maximum Temperature	Historical 1980-2010	1980 - 1990	1991-2000	2001-2010	change in 1991-2000 compared to 1980-1990	change in 2001-2010 compared to 1991-2000
Annual	31.6	31.6	31.5	31.6	-0.1	0.1
Winter	31.0	30.9	31.0	31.2	0.1	0.2
Summer	33.4	33.5	33.4	33.2	-0.1	-0.2
SWM	31.4	31.4	31.4	31.5	0.0	0.1
NEM	30.1	30.2	30.0	30.2	-0.2	0.2
Jan	30.5	30.3	30.4	30.7	0.1	0.3
Feb	31.7	31.6	31.7	31.7	0.2	0.0
Mar	33.1	33.0	33.3	33.0	0.3	-0.3
Apr	33.6	33.7	33.6	33.3	-0.1	-0.4
May	33.6	33.9	33.4	33.4	-0.5	0.0
Jun	31.9	31.8	31.8	32.0	0.0	0.2
July	31.3	31.4	31.0	31.3	-0.4	0.3
Aug	31.2	31.1	31.2	31.3	0.0	0.1
Sep	31.4	31.3	31.5	31.4	0.2	-0.1
Oct	30.7	30.8	30.6	30.7	-0.3	0.2
Nov	29.8	29.9	29.8	29.8	-0.1	0.0
Dec	29.9	29.9	29.7	30.1	-0.1	0.4

Table 5: Mean Minimum temperature in ^{0}C

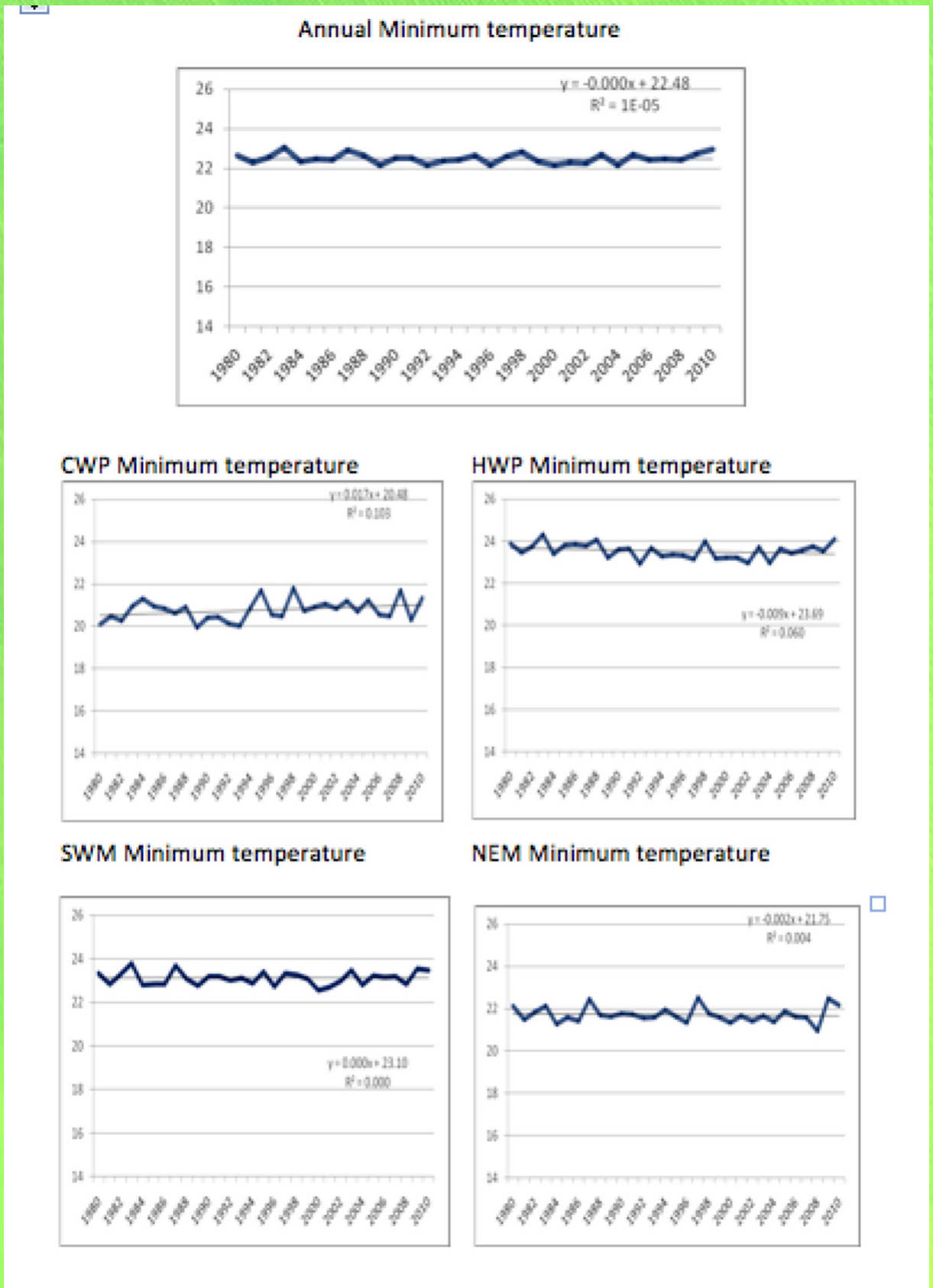
Minimum Temperature	Historical 1980-2010	1980 - 1990	1991-2000	2001-2010	change in 1991-2000 compared to 1980-1990	change in 2001-2010 compared to 1991-2000
Annual	22.5	22.5	22.5	22.4	-0.1	0.0
Winter	20.8	20.6	20.7	20.9	0.1	0.2
Summer	23.5	23.8	23.4	23.4	-0.3	0.0
SWM	23.1	23.1	23.1	23.0	0.0	-0.1
NEM	21.7	21.8	21.7	21.6	0.0	-0.2
Jan	20.4	20.3	20.2	20.5	-0.1	0.3
Feb	21.2	21.0	21.3	21.3	0.3	0.0
Mar	22.7	22.7	22.5	22.8	-0.2	0.3
Apr	23.9	24.1	23.8	23.6	-0.2	-0.2
May	24.1	24.5	23.9	23.8	-0.6	-0.1
Jun	23.4	23.4	23.5	23.3	0.1	-0.2
July	23.1	23.1	23.0	23.1	-0.1	0.1
Aug	23.1	23.1	23.0	23.0	-0.1	0.0
Sep	22.9	22.9	22.9	22.8	0.0	-0.1
Oct	22.4	22.5	22.5	22.3	0.0	-0.2
Nov	21.8	21.8	21.9	21.7	0.0	-0.2
Dec	20.9	21.0	20.9	20.8	-0.1	-0.1

Figure 9: Annual and seasonal Maximum temperatures



B. Minimum temperature

Figure 10 Annual and seasonal Minimum temperatures



B. Temperature Extremes

Table 6: Extreme temperatures- One day Highest maximum temperature in ^{0}C

Highest Maximum Temperature	Historical 1980-2010	1980 - 1990	1991-2000	2001-2010	change in 1991-2000compared to 1980-1990	change in 2001-2010compared to 1991-2000
Annual	35.9	35.9	35.9	35.5	0	-0.4
Winter	34.2	33.5	34	34.2	0.5	0.2
Summer	35.9	35.9	35.9	35.5	0	-0.4
SWM	35.6	35.3	35.6	35	0.3	-0.6
NEM	33.5	32.8	33.1	33.5	0.3	0.4
Jan	32.7	32.1	32.7	32.3	0.6	-0.4
Feb	34.2	33.5	34	34.2	0.5	0.2
Mar	35.4	35.1	35.4	34.9	0.3	-0.5
Apr	35.8	35.8	35.8	35.5	0	-0.3
May	35.9	35.9	35.9	35.4	0	-0.5
Jun	35.6	35.3	35.6	35	0.3	-0.6
July	34.1	34.1	33.5	33	-0.6	-0.5
Aug	33.7	33.4	32.9	33.6	-0.5	0.7
Sep	33.6	33.6	33	33.4	-0.6	0.4
Oct	33.5	32.8	33.1	33.5	0.3	0.4
Nov	32	32	31.5	32	-0.5	0.5
Dec	31.8	31.8	31.3	31.8	-0.5	0.5

Table 7: Extreme temperatures- One day lowest minimum temperature in ^{0}C

Lowest Minimum Temperature	**Historical 1980-2010**	**1980 - 1990**	**1991-2000**	**2001-2010**	**change in 1991-2000compared to 1980-1990**	**change in 2001-2010compared to 1991-2000**
Annual	16.9	17.6	16.9	18.1	-0.7	1.2
Winter	16.9	17.7	16.9	18.3	-0.8	1.4
Summer	18.5	18.5	19.6	20.6	1.1	1
SWM	21.1	21.6	21.1	21.1	-0.5	0
NEM	17.6	17.6	18.2	18.1	0.6	-0.1
Jan	16.9	18.3	16.9	18.3	-1.4	1.4
Feb	17.7	17.7	18.6	18.8	0.9	0.2
Mar	18.5	18.5	19.6	20.6	1.1	1
Apr	21.1	22	21.5	21.1	-0.5	-0.4
May	21.3	22.3	22.2	21.3	-0.1	-0.9
Jun	21.5	21.8	21.5	21.6	-0.3	0.1
July	21.2	21.6	21.9	21.2	0.3	-0.7
Aug	21.2	21.8	21.3	21.2	-0.5	-0.1
Sep	21.1	21.6	21.1	21.1	-0.5	0
Oct	18.7	18.8	20.4	18.7	1.6	-1.7
Nov	18.1	19.4	20.1	18.1	0.7	-2
Dec	17.6	17.6	18.2	18.1	0.6	-0.1

3. CONCLUSIONS

- This watershed received an annual average rainfall of 896.8 mm. Out of 31 years of rainfall considered for the analysis, 7 years had normal rainfall, 6 years had above normal rainfall, 7 years had excess rainfall, 5 years had below normal rainfall and 6 years had deficit rainfall.
- The region receives uni-model rainfall with its major peak during Northeast monsoon (Oct-Dec). NEM receives average rainfall of 448mm (49.94 % of annual rainfall).
- South west monsoon contributes to 28.9 % of the annual rainfall and summer season contributes to 17.8% of the annual rainfall.
- Out of 31 years of analysis, rainfall during NEM, 6 years had normal RF, 11 years had deficit rainfall, 1 year had below normal RF, 3 year had above normal RF and 10 years had excess RF.
- This watershed received rainfall from SWM, during August itself. These rains could be utilized for land preparation. The rains received during August could be used for sowing the NEM crop. Peak rainfall is received dung October and November months.
- Recent past decade (ending with 2010), exhibited consecutive years of below normal rainfall during both southwest and northeast monsoon seasons, leading to consecutive drought years.
- Analysis of extreme rainfall showed that day with more than 25mm got declined, while, 50 and 75 mm/ day events increased in the recent past indicating occurrence of both drought and flood in the same season.
- From the historical temperature analysis over 31 year time period minimum and maximum temperatures showed slight increase in the recent past.
  Temperature extreme events analysis witnessed that magnitude of increase in minimum temperatures was higher than maximum temperature in all the seasons.

The Kadavakurichi watershed is very dry with high rainfall variability. It has mostly red sandy, sandy loam, sandy clay loam, red loamy and late rite soils with 1 to 5 per cent slope and pH value ranging from 7.1 to 8.4. In some of the area the soil have minimum depth and devoid of dense vegetation.

Major crops grown includes sorghum, cumbu, pulses, Jasmine, Pitchi, Mullai, Kanagambaram, Sevanthi, Kolikondai, Vadamalli, Marigold, tomato, brinjal, etc., Major livestock component in the study region are cow, goat, sheep and poultry. Around 60 per cent of the household depends mainly on agriculture for their livelihood. Around 30 of people in the watershed are agricultural labour. The main source of water for irrigation is from open wells and bore wells. In recent decades the people of the study watersheds observes frequent drought due to monsoon failure or delay in onset of monsoon or intermittent dry spell within the growing season, which results in uncertainty and fluctuation in crop yields. There are no proper measures to conserve the soil and water in the catchment.

Major concerns in the Selected Watersheds

Acute shortage of drinking water: Due to low rainfall and unsustainable water usage, there are acute shortage occur for drinking water as well as water for domestic purpose.
Soil erosion: Major part of the selected watersheds is affected by soil erosion. Lack of soil conservation measures, reduction in natural vegetative cover, inappropriate agriculture practices, change in land use pattern and arid climatic conditions have contributed to the removal of topsoil cover.

Deforestation: Indiscriminate felling of trees to meet the growing demand for fuel, fodder & wood by the rural community has resulted in deforestation. Unregulated grazing and lack of awareness of the community about the alternate source of energy also contribute to exploitation of natural resources.

Ground Water Exploitation: Due to the lack of water conservation measures, a large volume of water is wasted as run off resulting in poor groundwater recharge. To meet the growing needs of water for crop production, many open wells and bore wells are dug in the area. Lack of water management practices in agriculture and failure of monsoon further aggravates groundwater depletion. The farmers in these watersheds do not usually practice micro irrigation technologies such sprinkler and drip irrigation.

Chemical farming: Over the years, the usage of high doses of chemical fertilizers and pesticides in agriculture has highly polluted the soil and water resources. This induction of chemicals in the crops is likely to have a gradual adverse impact on the health of the watershed community. The loss of traditionally cultivated varieties that are suited to local conditions further adds to the problem. As the water table has gone down and the cost of chemicals is high, the cost of cultivation has increased considerably and the farmers are finding it uneconomical to cultivate their land. As a result, some part of the cultivable land has become fallow.

Lack of Awareness: A survey conducted in the watershed indicated that the literacy rate is 60 per cent. However, people are not very much aware of environmental protection, sustainable agriculture and proper use of natural resources. Empowerment of women also requires special attention.

Low socio economic condition: More than 80 per cent of the farmers in the watershed belong to small and marginal farmers category. They are highly vulnerable to changes on climatic condition. Even one extreme weather event during the growing season could impact their livelihood to a greater extent.

Lack of access to institutional credit: This leads to high dependence of the farmers to local moneylenders who charges high interest rates.

Lack of community based organizations and lack of awareness of Government development schemes and programmes

Migration: Consecutive years of failure in monsoon and resulting drought occur in the region has limited the scope for agriculture and allied practices. The farmers could not produce enough fodder for their farm animals during the past few years due to water scarcity. As a result of it, farmers have sold their cattle at low profit. Employment in agriculture, cattle rearing got declined and resulted in deterioration of living standards. People undertake distress migration to towns and cities like Tiruppur and Kerala in search of employment.

Project period

Project Period 2017 – 2021

Ref No. NB. TN. WDF /WDF CC- 01/ 192 /2016 – 17 dated 20 March 2017

In Kadavakurichi watershed, there are 523 beneficiaries including 181 landless labours distributed in Six villages viz., Veelinayakenpatti, Pappinayakenpatti, Jeyanayakenpatti, Mutharayarnagar, Kamatchipuram and Duraisamipuram..

Donors and supporting agencies

National Bank for Agriculture and rural Development (NABARD) supported the Climate proofing and Climate adaptation activity in the study area Technical support was provided from the Tamil Nadu Agricultural University.

Local Gram Panchayat, Nationalized Banks, CIRHEP, Reference communities of Kadavakurichi watershed also actively involved in implementing the programme mainly to sustain agricultural activities for improving the livelihoods of the people through watershed development interventions with Climate proofing aspects / approaches.

Project Facilitating Agency, CIRHEP, 11-2-6, D.No: 2/198.1, Baniyan Tree, Muniyandi Kovil Near, Veelinayakenpatti, Nilakottai-624208 Dindigul District, Tamil NaduS.India (9443805118) (cirhepnb19@gmail.com).

Vision of CIRHEP is "Building the capacities of the rural communities in conserving the Vaigai – Kaveri watersheds in Dindigul, Theni and Madurai Districts and making the area sustainable for better livelihood" and its mission is "to create a sustainable human - ecology relationship and improve the quality of rural life by starving to alleviate poverty, provide education and conserve the environment with active participation of the rural community".

Major beneficiaries of CIRHEP include small and marginal farmers, women and adolescents, school children & landless agriculture labours. It mainly operates over 25 villages around kadavakurichi Reserve Forest in Nilakottai and Ottanchathram taluk in Dindigul district in undertaking Kadavakurichi watershed Development programmes.

CIRHEP operates projects with support from NABARD, Tamil Nadu Watershed Development Agency (TAWDEVA), and District Rural Development Agency, Dindigul, Future Earth, Sweden, Friends Group of CIRHEP, SWEDEN. Flagship programmes of CIRHEP are Watershed Development Programmes of NABARD, Organic and Biodynamic agriculture promotion projects, Women empowerment programmes, Nature school programmes for children on environment, Training Centre for Natural Resource Management, Tree planting Project supported by LIFE – Japan. And Model watershed project -Supported by Ministry of Land resources through ICRISAT.

Financial details

Table 9: Financial Details NABARD

Sl. no	Particulars	Activities Cost	Management Cost	DPR	Total
1	Grant Sanctioned	38,75,000	10,00,000	1,25,000	50,00,000
2	Grant Released	38,75,000	9,00,000	1,25,000	49,00,000
3	Grant Utilized	38,75,000	10,00,000	1,25,000	50,00,000
4	Grant Balance	0	1,00,000	0	1,00,000

VWC status

WC Status : : **Registered**

(i) Total No. of members : 11 VWC members

(ii) No. of women members : 4 women as VWC members

(iii)Registration no. and date *(If registered)*: **Society No. 60/2005.dated 27 May 2005).**

Community contribution

Community Contribution:

(i) Total labor payment : Rs.1, 79,140

(ii) Total estimated value of Shramadan : Rs.36, 464

Shramadan as % of total labor cost : (36,464) x 100 = 16.91%

(1, 79,140 +36,464)

Women Development Activities:

(i) Status of SMS : **Formed**

If formed whether : **Registered**

(ii) Registration no. and date *(If registered)*: **Society No. 60/2012.dated 15 June 2012**

(iii) Bank Account details:-

(a) Bank account: **Opened**

If opened,

(b) Name of Bank Account: **Kadavakurichi Watershed Women SHG Federation**

(c) Name of Bank : **Canara Bank – Batlagundu.**

(d) Account No. : **SB A/c No.: 0946101023293**

(iii) Women's promotion:-

(e) Grant sanctioned for = Rs **2,50,000**

(f) Grant received = Rs. **2,50,000**

(g) Grant utilized = Rs. **2,50,000**

(h) Balance grant account = Rs. 25423.50 (as on January- 2021)

List of Capital items purchased out of WDF grant

Table 10: List of Capital items purchased out of WDF grant

Amount in Rs.)

. No	Item	Year of purchase	Amount
1	Rain gun	2006	Rs.25,000/

Aggregate Production Assessment:-

Table – 11: Impact of planned interventions on Crops productivity – Kadavakurichi

	Crops	Pre development		Post development (Estimated)		Post development (Actual)	
		Total (q)	Per capita Availability	Total (q)	Per capita Availability	Total (q)	Per capita Availability
A.	Creals						
1.	Bajra	1100	0.36 q	1365.95	0.45 q	1852	0.59 q
2.	Sorghum	1512	0.49 q	1523.45	0.50 q	1785	0.57 q
B	Pulses						
1.	Redgram	60	0.02 q	107	0.03 q	220	0.07 q
2.	Blackgram	-	-	37	0.01 q	85	0.02 q
3.	Lab lab	-	-	40.5	0.01 q	75	0.02 q
4.	Green gram	-	-	131.4	0.04 q	210	0.06 q
5.	Cowpea	480	0.16 q	97.05	0.03 q	106	0.03 q
C	Oilseeds						
1.	Castor	-	-	75.20	0.02 q	88	0.002 q
2	Gingili	-	-	25.35	0.008 q	14	0.004 q
D.	Plantation crops						
1.	Coconut	-	-	120	0.04 q	280	0.08 q
2.	Mango	-	-	115.25	0.04 q	180	0.05 q
3.	Sapota	-	-	80	0.02 q	105	0.03 q
4.	Amla	-	-	3	0.001 q	8	0.002 q
5	Lemon	-	-	4	0.001 q	12	0.003 q
6	Guva	-	-	1	0.0003 q	5	0.001 q
E.	Flowers						
1	Jasmine	-	-	1965.45	0.64 q	2475	0.79 q
2	Marigold	-	-	1309.8	0.43 q	2520	0.80 q
3	Pitchi & Mullai	-	-	200.55	0.06 q	1200	0.38 q
4	Kolikondai	-	-	1231.60	0.40	1880	0.60 q
5	Sevanthi	-	-	-	-	16500	5.27 q
6	Vadamalli	-	-	-	-	750	0.23 q
F	Vegetable crops						
1.	Tomato	-	-	15478.3	5.08 q	18765	5.99 q
2.	Brinjal	-	-	1549.80	0.51 q	2210	0.70 q

3.	Onion	20250	6.65 q	742	0.24 q	650	0.20 q
4.	Chillies	21000	6.89 1	10.8	0.003 q	13	0.004 q
5.	Drumstick	20250	6.65 q	1389.5	0.46 q	1820	0.58 q
6.	Ladies Finger	-	-	266	0.09 q	290	0.09 q
7.	Radish	-	-	270	0.09 q	140	0.04 q

Climate Proofing Project impact study has been done in the Kadavakurichi Climate Proofing watershed by the team involved in the implementation works through household survey as well as field level studies conducted and consolidated. Project completion report has been prepared by comparing the field survey and FSR done during implementation of CPP. The following are the outcome of the Impact study has been conducted and analyzed in terms of groundwater level and availability, based on which land , agriculture, and livelihood development status

SECTION 2

Methodology

Following methodology was adopted to evaluate the climate proofed watershed programme.

Data Collection

To assess the watershed programme, extensive field visits were made, discussed with individual farmers, collected the field level data, and interacted with the SHG members, Village Watershed Committee members and the project implementing agency officials and field level workers. Case studies with individual farmers were also conducted to capture the impact at individual level.

Using Bhuvan tool

Data are identified according to their locations and makes it possible to link, or integrate information in the form of a map and attribute tables. Presenting data in the form of a map helps to understand the significance of completed activity and its impact.

All the intervention under taken at the individual farmers field, common assets aerated in the watershed as well as relevant data were brought in the bhuvan platform.

Impact indicators

For the major activities, following impact indicates were identified. Baseline data was compared with the current situation to identify the impact.

Table 12: Climate proofed watershed activities Vs. Impact indicators

Activities	Impact Indicators
Creation of Sunken Pond to reduce the soil erosion and to increase the water storage capacity and water use efficiency of the field against the increasing climate variability	• Crop productivity • Area under cultivation
Well recharge pits to collect the runoff rainwater from the field into the existing wells in order to increase the water level in the wells to reuse it for irrigation during drought season or delayed monsoon period.	• Area irrigated by the well • Well depth in comparison to the reference well • Crop productivity
Summer Ploughing to open up the hard surface soil in order to increase the infiltration rate of the rainfall, to control weeds and soil harbouring pest and diseases. This is also a strategy to capture whatever moisture that falls during the SW monsoon period so as to have planning if there is any delay in the NE monsoon.	• Area under cultivation • Ground water level
Deep Tillage to break the hard pan below the surface soil and to decrease the runoff from the soil during high intensity rainfall	• Soil erosion control • Land productivity
Application of Tank silt, biogas slurry and Vermi- compost to improve the soil health and quality parameters like organic matter content and water holding capacity amidst high	• Soil carbon, soil organic matter content and macro and micro nutrients before and after the project intervention

surface runoff	• Area under organic cultivation
Bund plantation and Agro horticulture to cultivate the perennial crops in combination with the annual crops to provide off season income, fodder to animal as well as to provide favourable micro-climate for the productivity of annual crops; risk reduction strategy	• Number of trees • Survival percentage • Carbon sequestration calculation using conversion factors
Plantation of fodder trees for gully stabilisation The land area available per household / per capita for cultivation is expected to decline in the future years due to change in socio economic characteristic and induced impact due to climate variability. Under such context, allocating sizable area of land for fodder production would lead to addition stress on cultivation of food crops. Enriching the fodder with nutrients will also increase the animal productivity	• Number of trees • Survival percentage • Carbon sequestration calculation using conversion factors • Getting good animal fodder. • Soil erosion control • Land productivity
Backyard fruit Plantation/ Horticulture Plantation Provides nutritional security, required vitamins and minerals for health life	• Nutritional security
Soil testing and issuing soil health card, Soil testing is an invaluable tool to any business that deals with soil or plant health. A proper soil test will help to determine the application of fertilizer needed to meet the crops' requirements while also taking advantage of the nutrients already present in the soil, thus being a very cost effective tool for managing a fertilizer program.	• Soil carbon, soil organic matter content and macro and micro nutrients before and after the project intervention.
Green manure cultivation, To improve soil strength and improve organic Matter in the soil. This encourages the yield of the crop.	• Soil carbon, soil organic matter content and macro and micro nutrients before and after the project intervention • Area under organic cultivation
Bio fertilizer, Bio fertilizers will be encouraged for the farmers for maintain improve of the soil fertility in organic form.	• Carbon sequestration calculation using conversion factors • Reduce production cost • Soil carbon, soil organic matter content and macro and micro nutrients before and after the project intervention
Bio control agents, Five leaf solution, Ginger garlic solution, Neem Cake solution etc. that colonises in soil, water and on plant surfaces. plant diseases by protecting the seeds and roots from fungal infections. This bacterium is mass-produced using fermentation technology.	• Carbon sequestration calculation using conversion factors • Reduce production cost • Soil carbon, soil organic matter content and macro and micro nutrients before and after the project intervention
Egg cards Each field placing 5 to 7 cards, different crops like Floriculture, vegetables	• Safe way of controlling pest. • Less costly

and pulses etc.	
Pheromone Traps, Fruit fly *Bactroceradorsalis* is the most destructive pest of mango With an aim to provide cost effective management strategies for farmers against this pest Pheromone traps – Methyl Eugenol (pheromone) will be used	• Safe way of controlling pest. • Less costly
Alternate crops, Instead growing crops like ground nut , finger millet cultivation in watershed area, the farmers need to encourage for cultivation of alternative crops like minor Millets	• Land productivity • Area under cultivation • Nutritional security • Less water conception
Intercropping, Encourage the farmers to grow inter cropping at mango orchard to maintain the land coverage with greenery during small plants of mangos (0 to 4 years)	• Land productivity • Area under cultivation • Nutritional security • Less water conception
Crop rotation, Crop rotation of cereals with pulses and oil seeds helps in maximum utilization of natural resources. Rotating shallow rooted crops with deep rooted crops will pave way for extracting nutrients from different soil layers. Leguminous crops will fix the atmospheric nitrogen and will help in balancing the soil nutrient status	• Land productivity • Area under cultivation • Nutritional security • Less water conception
Kitchen garden/Nutritional garden / The house hold of the watershed area are encouraged to grow the kitchen garden which maintain for the health status by avoiding mal nutrition diseases.	• Nutritional security • Reduce family expenditure cost. • Getting daily fresh vegetables through organic way.
Poultry unit (20 birds of Desi Chicken), The individual families are being encouraged to grow back yard poultry how are having the facility and encourages the family.	• To earn a additional amount for their livelihood • To maintain the health status
Agrl. Tool bank for SHG, Selective farmers/farm women's will be provided farm cultivation tools.	• Helps for drudgery reduction • Helps to keep continuation in agriculture labour works .
Weather based Agro Advisory Services, Installation of Automatic Weather Station on a cluster basis and dissemination of crop-weather advisory to farmers based on real time data. It is proposed to disseminate the advisories through mobile with a tie-up with a suitable Technology Service Provider	• To avoid the pest during the wind time. • To avoid the irrigation during raining time. • Timely getting awareness on agriculture and allied activities. • Reduce production cost
Posters and pamphlet on climate change adaptation, This method will be encourage for sharing the knowledge, developing the knowledge with less cost for the wider farming people	• Awareness creation about climate change.

Audio Visual Tools – short films, This methodology encourages the farmers to quick learn and also to develop the methods for their own experiences also act as a documentary	• Awareness creation about agriculture crops. • Reduce production cost • Increase the yield.
Trainings and Exposure visit, It is a platform to share and learn the topics which are to be practice on implementation of CCA Programmes and adaption of institutions.	• Awareness creation about climate change. • Adoption for new technology(CCA Farming)

Data analysis

Using the data collected in line with the impact indicators, the following analyses were made.

In an agrarian community it is not easy to compute incomes and expenditure using standardized formats. There are many variables and factors that influence a farmers' income that it becomes difficult to capture the impact using a standardized format. Further, each farmer's livelihood source is different. Market forces, on which the farmers have no control, play a major role in their livelihood choices; these forces are dynamic and display trend variation on a daily basis. In order to arrive at a clear indicator of increase in incomes, it is necessary to study these variations over a period of time, which is beyond the scope of this study.

For impact on natural resources such as soil and water, as no data has been collected pre or post project, farmers perception has been taken to assess the impact. Hence, this evaluation looks at only a few selected indicators of livelihood impact and impact on natural resources as detailed below:

A. Change in Natural resources
    a. Water sector
        i. Change in ground water table
        ii. Change in Drinking water availability
        iii. Change in soil water retention
        iv. Change in water availability for crop production
        v. Change in area under irrigation
    b. Soil health
        i. Soil erosion
        ii. Soil fertility
    c. Change in vegetation
        i. Green cover
    d. Energy conservation
B. Impact on livelihood
    a. Agriculture Sector
        i. Change in area under cultivation
        ii. Change in cropping pattern (crop diversification)
        iii. Change in productivity and production
    b. Animal Husbandry
        i. Feed availability
        ii. Livestock population
        iii. Livestock productivity
    c. Socio Economic
        i. Impact on migration
        ii. Impact on farm income
        iii. Change in living conditions
        iv. Change in education levels

v. Employment opportunities
vi. Change in knowledge level
    1. Community level capacity building
    2. Building the capacity of knowledge workers and field staff
vii. Access to Information Technology
    1. ICT interventions – IFFC O KISSAN

d. Project Spin-offs and Co-benefits
    i. Convergence with Government schemes
    ii. Women development activities
    iii. Community organizations

Summarising the benefits

Based on the above analysis, conclusions will be drawn to summarize the benefits of climate proofed watershed activities.

SECTION 3

Sanctioned activities and achieved targets

3.1. Kadavakurichi

Table 8: Activities sanctioned and supported by NABARD with physical and financial achievement – Kadavakurichi

SL. N	Treatment	Physical units in ha (or) Nos.			Grant in Rs.		
		Sanctioned	Achieved	% Achieved	Sanctioned	Utilized	% Utilized
I a	**Redesigning/New Construction of structures**						
1	Well recharge pit	71	71	100	457500	457500	100
2	Recharge pit in drainage line (Sunken Pit)	200	200	100	8880	8880	100
	Subtotal of redesigning / new construction of structures)				**466380**	**466380**	
I b	Improving vegetation cover						
1	Plantation of fodder trees for gully stabilisation	2000	2000	100	66800	66800	100
2	Backyard fruit plants	1000	1000	100	49000	49000	100
3	Bund Planting	1000	1000	100	33400	33400	100
4	Horticulture plantation	3500	3500	100	256760	256760	100
	Sub total for improving vegetative cover				**405960**	**405960**	
	Total for soil and water conservation				**872340**	**872340**	
II	**Soil health improvement and productivity enhancement (ha.)**						
1	Soil testing and issuing soil health card	100	100	100	30000	30000	100
2	Deep ploughing	40	40	100	160000	160000	100
3	Summer ploughing	140	140	100	420000	420000	100
4	Green manure cultivation 25 kg/ha @ 60/kg	8	8	100	12000	12000	100
5	Vermi Compost	30	30	100	200400	200400	100
6	Tank slit application/ Farm yard Manure (100 units/ Ha)	200	200	100	125000	125000	100
7	Bio fertilizer 5kg/ha or 2 litres/ha	121	121	100	121000	121000	100
8	Bio control agents 5 kg or 2 lit/ha	120	120	100	120000	120000	100
9	Egg cards	120	120	100	36000	36000	100
10	Pheromone traps	120	120	100	60000	60000	100
11	Azolla demo unit 10 x 2 x 2 feet	20	20	100	37760	37760	100
12	Honey bee keeping demo	4	4	100	8000	8000	100

	Total of Soil health and productivity enhancement				**1330160**	**1330160**	
III	**Sustainable NRM and climate resilient farming, livelihood and food security**						
1	Alternate Verities – Demo	100	100	100	150000	150000	100
2	Alternate crops – demo	100	100	100	100000	100000	100
3	Intercropping	200	200	100	300000	300000	100
4	Crop rotation	100	100	100	150000	150000	100
5	Seed treatment	300	300	100	60000	60000	100
6	Kitchen Garden/Nutritional garden	201	201	100	100500	100500	100
7	Poultry unit (20 units of desi chicken)	215	215	100	172000	172000	100
8	Agriculture tool bank for SHG	2	2	100	100000	100000	100
	Total of Sustainable NRM and climate resilient farming, livelihood and food security				**1132500**	**1132500**	
IV	**Mitigation of CC risk (no.)**						
1	Weather based Agro Advisory Services (375 farmers x 104 messages/yr x 4 years x Rs.0.30 + Laptop	1	1	100	80000	80000	100
2	Crop insurance			100	20000	20000	100
	Total of preventing climate change risks				**100000**	**100000**	
V	**Capacity building, Institutional development and knowledge management**						
1	Trainings Rs. 10000/ training	10	10	100	100000	100000	100
2	Exposure visit Rs. 20000/ visit	4	4	100	80000	80000	100
3	Posters and Pamphlet on climate change Adaptation	1	1	100	25000	25000	100
4	Audio visual tools - short films	6	6	100	90000	90000	100
5	Staff training	2	2	100	20000	20000	100
	Total of Capacity building, Institutional development and knowledge management				**315000**	**315000**	
VI	**Watershed level knowledge management**				125000	125000	100
	Total of Watershed level knowledge management				**125000**	**125000**	
	Sub Total (I to VI)				**3875000**	**3875000**	
VII	**Other Components**						
1	Project management cost				1000000	1000000	100
2	DPR Preparation				125000	125000	100
	Sub Total (VII)				**1125000**	**1125000**	
	GRAND TOTAL (I to VII)				**5000000**	**5000000**	

SECTION 4

Impact of interventions on Natural Resources - Water Sector

Following activities undertaken as a part of watershed development programme improved the water availability in the area.

a. Common activities undertaken
b. sunken Pond (Common land)

B. Farmers own initiatives
a. Drip irrigation.

C. Interventions undertaken in the individual farmers fields
a. Summer ploughing
b. Deep tillage
c. Well recharge pit

A. Common activities undertaken

Sunken pond: As the intensity of the rainfall is increasing due to extreme weather events, the top soil is lost due to erosion. To reduce the rate of erosion sunken pits were formed from starting point of drainage line. This has helped in reducing the flow of water and allowed more time to percolate in to the soil column both vertically and laterally.

Sunken pond

These common interventions have resulted in improving the water level in the wells by allowing more time for percolation and recharge. In Kadavakurichi, one Sunken pond was constructed.

Table 14: Common activities undertaken in the watershed to improve water recharge

Watershed	Village	No	Storage (CUM)
Kadavakurichi	VNP	0	0
	JNP	0	0
	PNP	0	0
	MNR	0	0
	KMP	1	200
	DMP	0	0
Total		**1**	**200**

These common interventions have resulted in improving the water level in the wells by allowing more time for percolation and recharge.

Farmers own initiatives: Micro Irrigation

Micro-irrigation refers to low-pressure irrigation systems that spray, mist, sprinkle or drip. Drip irrigation is the targeted, intelligent application of water directly to the root zone, fertilizer, and chemicals that when used properly can provide great benefits such as: Increased revenue from increased yields (up to 80%), increased revenue from increased quality, decreased water costs, decreased labour costs, decreased energy costs, decreased fertilizer costs, decreased pesticide costs and improved environmental quality. Water use is reduced by 40 – 60 %. Farmers have invested on drip irrigation using their own resources. In the pre intervention period, very limited area was covered under drip irrigation and there was no sprinkler irrigation. Due to the series of capacity building programmes, current status of micro irrigation in the study watersheds.

Table 95: Change in area under micro irrigation

Watershed	Village	Area under Drip Irrigation		
		2017 (Ha)	2020 (Ha)	No. of farmers following drip irrigation in 2020
Kadavakurichi	VNP	8	35	27
	JNP	2	8	8
	PNP	1	22	16
	MNR	0	0	0
	KMP	4	5	6
	DMP	1	3	3
Total		**16**	**73**	**60**

In the Kadavakurichi watershed only 16 ha of area was under drip irrigation and currently, the area under drip has increased to 73 ha.

Drip Irrigation

B. Interventions undertaken in the individual farmers fields

Interventions such as Well recharge pits, summer ploughing, deep tillage were undertaken in individual farmer's field with NABARD support.

Summer ploughing

Deep tillage

Table 16: Summer ploughing, Deep Ploughing and well recharge pit undertaken in Kadavakurichi watershed

Watershed	Village	Deep Ploughing		Summer Ploughing		Well recharge pit	
		Beneficiaries	No. of ha	Beneficiaries	No. of ha	Units	beneficiaries
Kadavakurichi	VNP	7	5.2	64	58.3	28	24
	JNP	17	11.9	42	40	3	3
	PNP	20	14.8	30	29.4	24	24
	MNR	10	8.1	9	6.4	10	10
	KMP	-	-	4	2.9	3	3
	DMP	-	-	4	3	3	3
Total		**54**	**40**	**153**	**140**	**71**	**71**

Well Recharge Pit

Impact Assessment- drinking water availability and water for domestic use

For impact on drinking water availability and water available for domestic use, as no data has been collected pre or post project period, farmer's perception has been taken to assess the impact.

Table 17: Impact of watershed programme on the drinking water availability

Scenario before 2017	Current scenario	Reason
a. Scarcity of water for human consumption b. Scarcity of drinking water for animal c. Not enough water for domestic use d. Water was purchased by many farmers from the fellow farmers who have water in their bore wells for domestic use e. Some of the farmers purchased water in tanker lorries to keep the perennial tree crops such as floriculture alive f. Distress sale of animal due to non availability of water	a. Water is available in all the farmers' field for drinking purpose, for their animal consumption and for domestic use. b. Increase in cattle population as farmers have started purchasing more animals due to enough water and fodder are availability in the watershed itself	a. Watershed activities have improved the ground water resources. b. Most of the rainwater falling in the land is made to conserve in the field itself and runoff is reduced to a greater extent.

Impact Assessment- Soil moisture retention and duration on water availability

For impact on soil moisture retention and duration of water availability due to lack of data collection in the pre or post project period, farmers perception has been taken to assess the impact.

Table 18: Impact of watershed development programme on soil moisture retention and duration of water availability for crop production

2017 Scenario	Current scenario	Reason
a. Water was available in the soil for the crops to use for 5 – 6 days after the rainfall event	Water is available in the soil for 10 – 15 days for the crops to use	Summer ploughing and deep Ploughing have helped in opening up of the soil layers and hence there is good infiltration rate. The water is available for 5 – 7 days more in the summer ploughed fields.
Water in the wells got drained within a week after the rainfall spell	Water level in wells got increased. More water was available for pumping to irrigate the crops 2 – 3 more irrigations were available for irrigating the crops during critical stages. This has resulted in more area under cultivation and more productivity of crops	Well recharge pits have increased the water table level in the wells by draining all the excess rain water into the wells. This has increased the water table levels in the well and water was available for 2 – 3 more irrigations during the critical stage of the crop

Impact assessment- Change in Irrigated area / area under irrigation

Table 19: Impact of watershed programme on change in area under irrigation (ha)

Watershed	Village	Drip Irrigation Area 2017	Drip Irrigation Area 2020	Changes	Changes %
Kadavakurichi	VNP	8	35	27	22.9
	JNP	2	8	6	25
	PNP	1	22	21	45
	MNR	0	0	0	0
	KMP	4	5	1	80
	DMP	1	3	2	33.3
Total		**16**	**73**	**57**	**21.9**

Case study – summer ploughing

Agriculture is the main occupation of a majority of the farmers in Kadavakurichi village. The main crops grown are Sorghum, bajra, maize, pulses, cereals, floriculture and vegetables. Due to recurrent drought, there is scarcity of adequate rainfall limiting agricultural activities. Farmers are facing scarcity in water to irrigate the crops, and are facing difficulties in undertaking crop production activities.

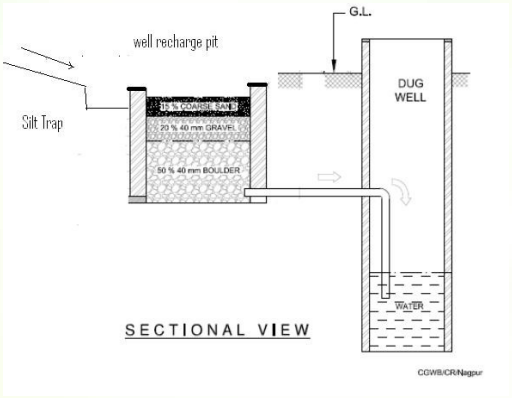
Summer ploughing and deep tillage are specific climate proofing activities on rain fed lands/dry lands. This activity helps in land preparation crucial for sowing of seeds. It pulverises the soil, exposes the pests to sun, thereby controlling their multiplication and increases the moisture holding capacity and fertility of soil. The first rain received in the soil is well stored in the soil itself which helps for the plants to have moisture for its crop growth.

Summer Plough

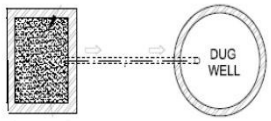
Case study – Well Recharge pit

The farmers in this village are facing an irregular monsoons and recurrent drought. This has adversely affected crop production and yields. Availability of ground water for irrigation is a big problem due to depletion of ground water resources. Farmers are facing increased challenges due to climate variability and uneven distribution of rainfall during the monsoon season. There was high run off from the area during high intensity rains. The top soil is eroded and run off rates are high from the watershed.

Well Recharge Pits to increase the rainwater harvesting in the watershed was suggested as climate proofing activity and contribute towards increased availability of water in wells for undertaking life-saving irrigations during long dry spells.



TYPICAL DUGWELL RECHARGE STRUCTURE



PLAN VIEW

Case studies

Case study 1: Mr. N.Pandi

Total farm income enhanced by more than two times.

Mr. N.Pandi from Pappinaickenpatti village in Kadavakurichi watershed The farmer has 3.5 acres of land

	Before Intervention	After Intervention
Area Irrigated	1 acres	1 acres
Crop 1	**Millet Pulses - 1 ac**	**Millet & Pulses – 1.5 ac**
Yield- Crop 1	400 kg	650 Kg
Net Income – Crop 1	Rs. 11,750	Rs. 17,300
Crop 2	**Seveanthiit – 0.5 ac**	**Seventhi – 0.7 ac**
Yield- Crop 2	2000 Kg	3600 Kg
Net Income – Crop 2	Rs. 1,00,000	Rs. 2,16,000
Crop -3	**Vadamalli – 0.5 ac**	**Vadamalli – 0.5 ac**
Field – Crop 3	500 kg	650 kg
Net Income – Crop 3	Rs. 10,000	Rs. 16,250
Crop -4	Mullai – 0.3 ac	Mullai 0.3 ac
Field – Crop 4	**480 Kg**	**720 Kg**
Net Income – Crop 4	Rs. 48,000	Rs. 86,400
Total farm income	**Rs. 1,69,750**	**Rs. 3,35,950**