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ADVANTAGE RECLAIMED

Longitudinal Study of Watershed and Non-Watershed Villages

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Research Report

WSD

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Executive Summary

The title of this years study is "Advantage Reclaimed" because the advantage enjoyed by the watershed villages over non-watershed villages that has been considerably reduced in the fourth year of drought has been reclaimed in the year 2004 because of good timely monsoon. The watershed villages were quick to regain their advantage over non-watershed villages and the degree of benefits from watershed programme is considerably high is very much evident from this years study.

Development Support Centre (DSC) is concerned about the progress of watershed programme and it believes that programme needs to be monitored over a period of time. As a part of this initiative this longitudinal study comparing watershed and non-watershed village is being carried out in drought prone areas of Gujarat. Eight Watershed and adjacent eight non-watershed villages are studied in Saurashtra and Kutch region of Gujarat.

The method of analyzing this yeas study is comparing the trend in watershed and non-watershed villages in ten critical parameters. The trend has been shown graphically and presented in *Anexure-1*. The findings of the studies point out that in the first year of drought in 1999-2000 the watershed villages are significantly better off than non-watershed villages. In the second year of drought in 2000-01 the watershed villages continue to enjoy advantage over non-watershed villages but the gap has been considerably reduced. In the fourth year of drought i.e. 2002-03 the advantage of watershed villages. In the fourth year of drought i.e. and non-watershed are facing the same difficult situation. When this villages were again revisited in the May 2004 and this year being a good year has heralded in prosperity in watershed villages in compare to non-watershed villages.

The watershed villages has performed exceptionally well in 6 parameters out of 10 studied parameters. There are 8 watershed villages where area under Rabi crop has increased where as in none of the non-watershed villages it has happened. In 7 watershed village and 4 non-watershed village there is increase in crop yield. In 2 watersheds villagers were able to take crop in three seasons i.e. Kharif, Rabi and summer and in the rest 6 watershed villages farmers were able to grow in both rabi and Kharif. Where as in none of the non-watershed villages they could grow crop in three seasons. In 6 non-watershed villages could grow both Kharif and Rabi crop and other 2 non-watershed villages could grow crop in Kharif only. Employment opportunities within the village are more in watershed villages in comparison to non-watershed villages. In 6 watersheds villagers got employment within the village for more than 6 months where as in 2 nonwatersheds they got employment for more than 6 months. There is one watershed village where villagers migrated for more than 3 months where as villagers from 4 non-watershed villages migrated for more than 3 months. The fodder availability round the year is in 6 watershed villages and in 4 nonwatershed villages fodder is available round the year. In case of food security the findings indicate that in 4 out of 8 watershed villages, food is available throughout the year where as in one non-watershed village food is available throughout the year.

The study has proved that watershed village does perform better than nonwatershed village but to ensure sustainability of the watersheds there is a need to systematically understand the causes of successful watershed and at the same time finding out the lacunas for further interventions. The watershed programme has to focus more on institution building and helping the Community Based Organisations (CBO) to play an active role. The CBO's can play the role of PIA after five years project; they can be trained in dovetailing funds from other government schemes for overall development of village and consequent improvement of livelihoods of the natural resource dependent community.

ADVANTAGE RECLAIMED

Longitudinal Study of Watershed and Non-Watershed Villages

INTRODUCTION

In India, agriculture is primary source of livelihood for 70% of its population in the rural areas. Agro based economy not only provides direct livelihood opportunities for substantial rural population but it also has indirect impact by generating employment for landless. In addition to this it also affects food security, fodder need and milk yield. However one of the factors that are putting extreme pressure on agro based livelihood opportunity is mismanagement of natural resources like over-utilisation of ground water and degradation of soil.

Integrated watershed management is considered to one of the best approaches that can help in soil and water conservation for better utilisation of natural resources. Watershed is a topographically delineated geographic area in which the entire run-off tends to converge, through the existing drainage system, to the common outlet of the area for subsequent disposal. Watershed approach, which was originally conceived as technological intervention, has evolved and now encompasses broader parameters like institution building, income generation, drinking water security etc. It is an attractive planning unit for effective soil and water conservation for maximizing the utilisation of surface and subsurface water.

The watershed guidelines issued by Ministry of Rural Development (MoRD), Government of India in 1994 also emphasised on optimum development of natural resources for socio-economic growth of the village using easy and affordable indigenous technology.

In any watershed programme it is important to find out if the programme is able to achieve its desired objectives. It is imperative from earlier studies that watershed has definitely helped in soil and water conservation but there is a need to chalk out the impact of watershed on the livelihood of the rural communities over a period of time particularly in drought years. At the same time there is also need to find out how watershed village is different from nonwatershed village and weather watershed management has played any critical role in implemented areas. It is with this aspect, watershed villages and nonwatershed villages are studied to suggest improvements in the watershed programme and make it sustainable.

BACKGROUND OF THE LONGITUDINAL STUDY

DSC is concerned about the impact of watershed development programme and is constantly involved with the progress of this programme that plays a important role in participatory natural resource management and helps in augmenting the livelihood of the villagers. As a part of its commitment towards sustainability of the watershed programme, DSC conducted a study in eight watershed and eight non-watershed villages in seven drought prone districts of Gujarat in 1999-2000. The objective was to find out how far a watershed development project (WDP) protects a village against drought. ("Eloquent 'Silent' Revolution", In the Hands of the People, 2001). Ten critical parameters were noted and assessed.

The study examined the impact in terms of the following parameters.

Drinking Water, Crop Season, Crop Area, Crop Yield, Fodder Availability, Cattle Population, Milk Yield of Cows & Buffaloes, Local Employment, Migration, Food Security.

The studies pointed out the some interesting facts about the watershed programme that supported the experts view about the benefits from the programme. However it was felt that rainfall pattern may play decisive role in overall impact of the programme in drought prone areas. Successive droughts for two to three years are not uncommon in drought-prone areas. There was also a need to find out that how long watershed can help the villagers to mitigate the drought condition. Therefore it was decided to carry forward this study in same sixteen villages (8 Watershed and 8 Non-Watershed) in drought-prone districts of Gujarat state over a time span. As a part of this series, a longitudinal study

entitled "Advantage Watershed" of impact of watershed in a year of severe drought in the livelihood of villagers was carried out in the month of May 2001 in same 16 villages.

The findings of this study point out the comparative coping pattern of watershed and non-watershed village in drought years. In addition to that, study also highlights the number of watershed villages that have been able to successfully cope the prevailing droughts and other watershed villages that have succumbed to the harsh conditions. However one of the findings of the study that raised concern was though watershed villages continued to enjoy the benefit over the non-watershed villages but the differential advantage enjoyed by the watershed village has been considerably reduced.

In May 2003 another year of drought, DSC revisited most of these villages and found that the differential was almost flattened as brought out in "Advantage Declined". The study also highlighted that watershed villages are not much different from non-watershed villages in fourth year of drought. Watershed that is basically land based activity aimed for soil and water conservation practically loses its significance in the subsequent years of drought. Therefore it is imperative to think deeply and look critically into areas like strengthening of institution building for drinking water security, management of fodder, grain banks income generation. There is also need to develop alternate sources of employment in drought years, training for agricultural productivity enhancement programmes then only watershed programme can be sustainable and have a positive impact on the livelihood of the watershed community.

THE OBJECTIVES OF THE STUDY ARE:

- Study the impact of drought in the watershed and non-watershed villages over a period particularly in drought years.
- Study the role of watershed in drought mitigation.
- Find out the factors that can help to make watershed programme sustainable in successive drought years.

STUDY AREA AND METHODOLOGY

The research study compares two sets of villages with similar socio-economic and geographic profile. One village with the benefit of watershed programme for last 5 years and 70 % of the grant meant for the watershed programme has been utilized. The second is the adjoining village without the benefit of the watershed programme. The study focused on studying drought prone areas of Gujarat. Seven drought prone districts namely Amreli, Banaskantha, Jamnagar, Kachcch, Rajkot, Sabarkantha and Surendranagar. Initially Eight watershed villages and Eight Non-Watershed villages from eight districts was selected to be studied. Savarkundla, one of the talukas from which sample villages have been chosen, was part of Bhavnagar district earlier. After sometime in Gujarat districts were reorganised and Savarkundla it became part of Amreli district. As a result, there were no samples from Bhavnagar district. Thus although there were eight talukas and sixteen villages in the sample, the total number of districts went down to seven.

The primary data was collected through participatory rural appraisal techniques, field observations and focused group discussions. The secondary data consisted of land use pattern, area under cultivation and irrigation, accomplishment of village under watershed program.

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Project Implementing Agency (PIA)	District	Taluka	Watershed Village	Non-watershed Village
Development Support Centre	Amreli	Dhari	Khicha	Veerpur
GRISERV	Rajkot	Jasdan	Bhupgarh	Ramadiya (has a WDP now)
M.G. Patel Sarvoday Kendra	Banaskantha	Vav	Padan	Jaloya (has a WDP now)
S.K.T.G.S.M.	Amreli	Savarkundla	Dedakdi	Thordi
ANäRDe Foundation	Sabarkantha	Malpur	Kanera	Pisal
Gramya Vikas Trust	Jamnagar	Okha Mandal	Lourali	Kuranga
Sahjeevan,	Kachchh	Nakhatrana	Laiyari	Tal
Gujarat Land Development Corporation.	Surendranagar	Chotila	Bhimgarh	Kalasar

Names of Project Implementing Agencies and Sample Villages

Drinking Water Status	1999-2000		200	2000-01		2002-03		2003-04	
	WSD	NWSD	WSD	NWSD	WSD	NWSD	WSD	NWSD	
Available through out the year	5	1	6	6	5	6	4	6	
Moderate problem (available till April)	2	1	0	0	1	0	3	1	
Problem: (available till February)	1	2	0	0	0	0	1	1	
Severe Problem (available till December)	0	4	0	0	0-	0	0	0	
Not Available	0	0	2	2	2	2	0	0	

Table 1: Drinking Water Availability

Watershed Village: In the year 2003 we find there were 5 villages where drinking water was available throughout the year, however in 2004 there are only 4 villages where water is available round the year. Khicha village where water was available round the year, however in 2004 in this village water is available till April. The main reason for this is that last year water was supplied through pipelines but this year water was not supplied by pipeline. 2 villages Bhupgarh and Kanera were facing severe problem. In the year 2003 due to good monsoon water table in the wells has risen and water is available till April and they are facing moderate problem in Bupgarh. In Kanera there was only 1 lake and now another lake was constructed under watershed. Apart from that water is also supplied by pipeline and water table in well has risen due to good monsoon. In both Bupgarh and Kanera, villagers were of the view that water stored in the check dam has helped in increasing the water table in the well. In Bhimgarh village there was moderate problem in 2003 but in the year 2004 it is facing problem, as water is available till February. In this village water table is going down and no recharge has taken place.

Control Village: In the year 2003, there were 6 villages where drinking water was available throughout the year and the situation is same in 2004. In Pisal village there was severe problem in 2003 but situation has improved in 2004 and

drinking water is available till April. This is because in this village Gram Panchayat has dug one tube well. In Kalasar village there was severe problem in 2003 but in the year 2004 it is facing problem and situation has improved. The main reason is this that Gram Panchayat had dug tube well in this village which has helped to improve the situation considerably.

In brief from the above analysis we find that contrary to expectations watershed villages are facing more drinking water crisis compare to control villages. The table clearly highlights that in the year 2004 in spite of good monsoon and advantage of watershed there are 3 watershed village which are facing problem compare to 1 control village. One of the primary reasons is that in only 2 watershed village initiative has been taken to mitigate drinking water needs but in rest of the 6 watershed villages no such initiative has been taken. Even in the 3 watershed villages where water is available round the year is due water supply by Gujarat Water Supply and Sewerage Board (GWSSB) and in 1 village well recharge has taken place due to watershed programme.

In the 3 out of 6 control villages where water is available round the year is due to water supplied in these 3 villages by GWSSB. In 1 village water is supplied round the year by tankers by TATA Chemical Society for Rural Development (TCSRD). In 1 village stand post has been constructed and water is supplied from overhead tank which is filled from bore within the village. In 1 village 3 ponds have been dug which has ensured round the year water availability.

Table2:CropSeason

Crop in Different	1999-200	1999-2000		2000-01		2002-03		2003-04	
Seasons	WSD	NWSD	WSD	NWSD	WSD	NWSD	WSD	NWSD	
Three Seasons (Kharif, Rabi & Summer)	3	0	1	0	0	0	2	0	
Two Seasons (Kharif & Rabi)	2	0	2	1	5	4	6	6	
One Season (Kharif)	1	3	4	6	2	4	0	2	
One Season (Rabi)	0	0	1	1	1	0	0	0	



The number of season a farmer is able to grow crop is directly proportional to the irrigation available. In Kharif there is not much of change in crop season as Kharif is very much dependent upon monsoon. In Kharif farmers can have benefit of water harvesting structure if there is a good rain and water gets stored in WHS. Then this water can be used for supplementary irrigation. However watershed can have a positive impact by providing additional water for Rabi. Where as in non-watershed villages there are few WHS and hence they don't enjoy the benefit of supplementary irrigation. Graph given above shows that over four years of study none of the non-watershed villages could take crop 3 seasons. In case of watershed villages the there were 3 watershed villages that could take 3 seasons crop in 1999-2000, in the second year of drought in 2000-2001 the number decreased to 1 village and in the fourth year of drought the situation is

same in watershed and non-watershed villages as none of them could take crop in 3 seasons. In the year 2003-04 there was good rainfall and watershed villages have again regained advantage as there are there are 2 watershed villages that could take crop in 3 seasons.

Watershed Village: The progressive trend of watershed village in the studied four years shows that in the first year of study i.e. 1999-2000 there were 3 watershed village that could take three seasons crop, in 2000-01 there was one watershed village that could take crop in three seasons. In 2002-03 none of the watershed village could take crop in three seasons. In the year 2004, in 2 villages farmers have grown crops in 3 seasons where is in 2003 in none of the watershed village has reclaimed their advantage over non-watershed village. In Kicha village of Dhari block and Laurali village of Dwarka are the two villages where farmers could take crop in three seasons. In 6 villages farmers could grow crop in 2 seasons where as in the year 2002-03, farmers in 5 villages were able to grow crop in 2 seasons.

Control Village: In none of the control villages, farmers were able to grow crops in 3 seasons. In the year 2003-04, farmers in 6 control villages could grow crop in both Rabi and Kharif. In 2002-03 farmers in 4 control villages farmers were growing crop in 2 seasons .In 2000-01, there was one non-watershed village that could grow crop in 2 seasons. Where as in 1999-2000, none of the non-watershed village could grow crop in 2 seasons.

Table 3: Crop Area

Crop Area	1999-2000		2000-01		2002-03		2003-04	
	WSD	NWSD	WSD	NWSD	WSD	NWSD	WSD	NWSD
Increase in cropped area.	0	0	1	0	0	0	0	0
No change.	3	0	6	1	6	0	7	5
Up to 25 % decrease in cropped area.	1	0	0	0	2	1	1	3
25 – 50 % decrease in cropped area.	1	1	0	0	0	0	0	0
50 – 75 % decrease in cropped area.	0	2	0	0	0	0	0	0
More than 75 % decrease in cropped area.	1	1	0	0	0	0	0	0



The impact of variation of rainfall is more on the area under Rabi crop than area under Kharif. In the studied villages the Kharif has not shown much change due to variation of rainfall and hence the graph presented above gives the change in Rabi crop area over years. In case of non-watershed villages in the first two years of study i.e. in 1999-2000 and in 2000-01 none of the villages shows any increase in Rabi crop area. In 2002-03 though being drought year in one nonwatershed village there was water in well due to good rains in that village, farmers said there were increase in Rabi area. In 2003-04 the same village there was increase in Rabi crop area but in none of the other non-watershed villages farmers said that there was increase in Rabi crop area. Incase of watershed villages in the first year of drought in 1999-200 there were 3 watershed village which showed increase in Rabi crop area, in the year 2000-01 there were 2 villages where there was increase in rabi crop area where as in the fourth year of drought the watershed village are not different from non-watershed villages. In 2003-04 the year of good monsoon the watershed villages has shown significant increase in Rabi crop area with all the 8 watershed villages showing increase in rabi crop area.

Watershed Village: Crop area has increased in watershed village in the year 2003-04 as compare to the year 2002-03. The area under Kharif crop has remained same from the previous year in 7 villages where as in one village, Dedakadi of Savarkundla, kharif area decreased slightly by 5 Ha. In Kharif season, groundnut and cotton has mainly grown by farmers. In 6 villages, area under groundnut has increased. In 4 villages, area under cotton has increased. However increase in the area of groundnut and cotton has taken place in place of Jowar and millet. The area under Jowar has decreased in 2 villages, where as area under millet has decreased in 5 villages, as farmers have preferred growing cash crop like groundnut and cotton. Farmers were of the view that by growing cash crops they could earn more profit which they can save and use this money for purchasing grains and that's why do not prefer growing millet and Jowar as these crops fetches them less remuneration.

In the year 2004, in all the 8 watershed villages area under Rabi has increased where as in the year 2003 there were there was only village where area under Rabi has increased. In 4 villages, Kanera, Bhupgadh, Kicha and Laurali area under wheat has increased, in 2 villages, Bhupgadh and Bhimgadh area under cumin has increased, in one village, Kanera there is increase in castor and in one village there is increase in area under mustard and in one village, Laurali the area under chilly has increased. In 2 villages, Bhimgadh and Kicha area under gram has decreased because in Kicha village, farmers have shifted to growing

wheat where as in Bhimgadh village have started growing vegetables. In Dedakadi village area under onion has decreased, as farmers are not getting the desired prices as per the investment made.

Control Village: In none of the control village, crop area under Rabi and Kharif has increased from the previous year. In 5 control village's area under Kharif has remained same and in 3 control villages, area under Kharif has decreased in the range of 1-5%. In 5 villages, area under groundnut has increased, in 3 villages area under Jowar has increased, in 2 villages, area under oil seeds has increased and in one village, area under pulses has increased. In 4 villages, area under cotton has decreased. The area under cotton has decreased because there was no source to store water and water table in the wells has gone down. Farmers were also of the view that rainwater runs off in the absence of any checking facility. In 2 villages, the area under Jowar has come down have farmers have shifted that area to groundnut.

In 4 control villages, area under Rabi has remained same. However situation has bit improved in control villages as in 2003 there were only 4 villages which could grow Rabi crop where as in 2004 they are growing rabi crop in 6 villages. Thordi and Kalasar are the two more villages along with the above-mentioned 4 villages that could grow Rabi crop. Wheat and Cumin are the two crops that have mainly grown in Rabi. In 2 villages, area under cumin has increased. In 3 villages, area under wheat has come down because in 2 villages, area under wheat has shifted to growing cumin, where as in one village, area under wheat has come down as there is scarcity of water for irrigation. In 2 villages, area under wheat has remained same, in 2 villages, area under cumin has remained same, in 2 villages, area under cumin has remained same, in 2 villages, area under cumin has remained same, in 2 villages, area under cumin has remained same, in 2 villages, area under cumin has remained same, in 2 villages, area under cumin has remained same, in 2 villages, area under same where as in one village, area under mustard has remain same.

Crop Area in 2003-2004

Season.	Crop.	Crop Area	Increased	Crop Area	Decreased	Crop Area Remained Same		
		Watershed	Control	Watershed	Control	Watershed	Control	
Kharif.	Groundnut	6	5	0	1	1	1	
	Cotton	4	0	0	4	0	1	
	Jowar	0	3	4	2	1	2	
	Millets	0	1	7	3	0	3	
	Maize	0	0	1	2	2	2	
	Oil Seeds	1	2	2	2	3	1	
	Guwar	1	1	0	0	0	0	
	Pulses	0	1	0	0	1	1	
Rabi.	Wheat	4	0	0	3	1	2	
	Castor	1	0	0	0	0	0	
	Chilly	1	0	0	0	0	0	
	Vegetable	1	0	0	0	0	0	
	Cumin	2	2	0	0	1	2	
	Mustard	1	0	0	0	0	1	
	Gram	1	0	2	0	0	2	
	Onion	0	0	1	0	0	0	
Summer	Maize	1	0	0	0	0	0	
	Mango	0	0	0	0	1	0	

Table4:Crop Yield

Change in Yield.	1999-2000		2000-01	2000-01		2002-03		
	WSD	NWSD	WSD	NWSD	WSD	NWSD	WSD	NWSD
Increase in Yield.	1	0	1	0	1	0	7	4
No change in Yield.	1	0	4	0	3	4	0	0
Up to 25 % decrease in Yield.	2	0	0	0	0	0	1	4
25 – 50 % decrease in Yield.	1	0	2	0	0	0	0	0
50 – 75 % decrease in Yield.	1	0	0	0	0	0	0	0
More than 75 % decrease in Yield.	0	4	0	4	0	0	0	0
Crops Failed.	2	4	1	4	4	4	0	0



The trend in the crop yield has remained same in the drought years from 1999-2000 to 2002-03. In case of watershed village in all the drought years there was one village in which there was increase in yield. In case of non-watershed in the drought years in none of the villages there was increase in crop yield. In the 2003-04 with good monsoons the crop yield increased in both watershed and non-watershed villages, however number of watershed villages were than non-watershed villages. In 2003-04, crop yield increased in 4 non-watersheds where as in 7 watershed villages there was increase in crop yield.

Watershed Village: Good monsoon coupled with water storage in water harvesting structures has played a prominent role to increase the crop yield in watershed villages. In the year 2004 there are 7 watershed villages where crop yield has increased where as in 2003 there was1 village where crop yield has increased. In Laiyari village crop yield has decreased by 25% due to disease. There were 4 villages where crops had failed in 2003 where as in 2004 in none of the villages crop had failed. In Kharif season, Groundnut production has shown maximum yield in 6 villages, where as Padal and Laiyari village did not grow groundnut. In 4 villages, yield of cotton has increased. Yield of Millet has decreased in 6 villages, as farmers have shifted to growing cash crops like Groundnut and Cotton, as there is increased availability of water for irrigation.

In Rabi season, wheat yield has increased in 6 villages except in Padan and Laiyari. In 3 villages, there is increase yield of cumin. In one village, yield of gram has come down and in one village; yield of onion has come down. In both the villages, farmers have shifted to growing wheat in place of gram and onion.

Control Village: In the control villages also situation has improved a lot. There are 4-control villages there is increase in crop yield. In none of the control village crops have failed in 2004, where as in 2003, crops have failed in 4 control villages. However in 4-control villages, yield has decreased upto 25%. In Kharif season, in 5 villages, groundnut yield has shown increase. In 2 villages, yield of cotton has increased. In 3 villages, production of millet has increased. In 3 villages, yield of cotton has decreased due to water scarcity. In one village yield of maize has decreased. In 2 villages oil seeds yield has decreased where as in 2 villages yield of millet has decreased. In these villages, farmers have shifted to growing groundnut.

In Rabi season, in 1 village, Kurunga wheat yield has increased. In 3 villages, Veerpur, Kalasar and Jaloya yield of cumin has increased and in one village yield of gram has increased. In two villages, Tal and Pisal farmers were not able to take Rabi crop due unavailability of water. In two villages, Veerpur and Kalasar yield of wheat has decreased due to less water and in place of wheat they have shifted to cumin.

Season.	Crop.	Incr	ease	Dec	rease	Remain	ed Same.
	-	Watershed	Control.	Watershed	Control.	Watershed	Control.
Kharif.	Groundnut.	6	5	0	0	0	1
	Cotton.	4	2	0	3	0	0
	Jowar.	4	5	1	0	1	1
	Millets.	1	3	5	2	1	2
	Maize.	1	0	0	1	0	0
	Oil Seeds.	4	3	1	2	0	0
	Guwar.	1	1	0	0	0	0
	Pulses	2	1	0	1	0	2
Rabi.	Wheat.	6	1	0	2	0	1
	Castor.	1	0	0	1	0	0
	Chilly.	1	0	0	1	0	0
	Vegetable.	1	0	0	1	0	0
	Cumin	3	3	0	1	0	1
	Mustard	2	0	0	1	0	0
	Gram.	2	1	1	1	0	1
	Onion.	0	0	1	1	0	0
Summer	Maize	1	0	0	0	0	0
	Mango	1	0	0	0	0	0

Crop Yield

Table	5:	Fodder	Availability
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Fodder Availability	1999-2000		2000-01		2002-03	2002-03		2003-04	
	WSD	NWSD	WSD	NWSD	WSD	NWSD	WSD	NWSD	
Available throughout the year.	2	0	3	3	1	1	6	4	
Moderate Problem (Available Till April)	5	0	-	1	0	1	2	4	
Problem (Available Till February)	1	1	1	1	2	0	0	0	
Severe Problem (Available Till December)	0	7	4	1	3	3	0	0	
Fodder unavailable in Village.	0	0	0	2	2	3	0	0	



Fodder availability is proportional to the crop productivity as farmers use crop residue as fodder. The graph given above show that fodder availability varies with the rainfall. In 1999-2000 there was 2 watershed where was fodder was available throughout the year where as in none of the non-watershed village fodder was available throughout the year. In the 2000-01 the second year of drought, however the graph shows that there is increase in fodder availability. This is because fodder was distributed as scarcity relief measure. In 2002-03 the year of severe drought there is 1 watershed as-well-as in 1 non-watershed fodder was available throughout the year. In this year fodder was distributed but the scale of drought was high and as result the fodder was not available throughout the year of good monsoon, fodder was available throughout the year in 6 -watershed where as in 4 non-watershed village

Watershed Village: Fodder available within the village has also improved in 2004. In 6 villages, fodder is available throughout the year where as in 2003 in only one village fodder was available throughout the year. Residues of groundnut, millet, maize and Jowar are mainly used as fodder. Groundnut residue is preferred as fodder. In 6 villages except Padan and Laiayri groundnut residue is available, in all the 8 villages millet and Jowar is available as fodder. 2 watershed villages, Laurali and Bhimgadh faced moderate problem as fodder was available till April, however the condition in these two villages has significantly improved when compared to 2003 because last year in Laurali and Bhimgadh villages.

Control Village: Fodder availability within the village has also improved in control villages. In 4 villages, fodder is available throughout the year where as other 4 villages, faced moderate problem as fodder was available upto April. In 3 villages, groundnut is preferred as fodder where as in 4 villages residue of Jowar is used as fodder.

Watershed villages had recovered quickly compared to control villages after a good monsoon. In 2003, 7 watershed and control villages which had fodder scarcity. In 2004 there are 2 watershed villages that are experiencing fodder scarcity compared to 4 control villages.

Change in cattle population	1999-200	1999-2000		2000-01		2002-03		2003-04	
	WSD	NWSD	WSD	NWSD	WSD	NWSD	WSD	NWSD	
Increase	0	0	0	0	0	0	6	6	
No Change (Compared to the normal year)	0	0	1	1	3	5	0	1	
Less than 10 % decrease.	5	1	1	0	0	0	1	0	
10 - 20 % decrease.	1	1	0	1	1	2	0	0	
20 - 30 % decrease.	2	0	2	1	2	1	0	0	
30 - 50 % decrease.	0	2	2	4	1	0	1	0	
50 - 75 % decrease.	0	4	2	1	1	0	0	1	

Table 6: Changes in Cattle Population

Watershed Village: Situation in watershed village has improved in compare to last year. Cow population has increased in 6 watershed villages .cow population has decreased by 10% because they have sold as well as migrated as they have started keeping buffalo. In Laurali village cow population has decreased in the range of 30-50% as they have started rearing buffaloes. In 4 villages population has increased. In Kicha village, buffalo population has decreased by less than 20-30% where as in Laiyari village; buffalo population has decreased in the range of 30-50%. In Bhupgadh village, buffalo population has decreased in the range of 10-20%.

Control Village: In 6 villages, cow population has increased. In Kalasar village cow population has remained same. In Tal village cow population has decreased by 50-75% due to fodder unavailability, there has been large-scale migration as well as cow has been sold. In 6 villages, buffalo population has increased. In Kurunga village, buffalo population has come down in the range of 10-20% because of fodder scarcity. In Jaloya village there is 30-50% reduction in the buffalo population due to fodder scarcity and they have migrated and sold their cattle.

Average yield in	1999-200	0	2000-01		2002-03		2003-04	2003-04		
ltrs/day	WSD	NWSD	WSD	NWSD	WSD	NWSD	WSD	NWSD		
0-1	1	4	1	4	0	0	0	0		
1.1 to 2	6	2	6	2	0	2	0	0		
2.1to 3	1	2	1	2	7	3	0	0		
3.1 to 5	0	0	0	0	1	1	2	4		
5.1 to7	0	0	0	0	0	2	5	4		
7.1 to 9	0	0	0	0	0	0	1	0		
Above 9.1	0	0	0	0	0	0	0	0		

Table 7: Milk Yield (Cows)

Watershed villages have fared better than the control villages in 2003-04. There is one watershed villages in which per-day milk yield is in the range of 7.1 to 9 liters where as in none of the control villages milk yield was in the range of 7.1 to 9 liters.

Watershed Village: Milk yield of cow in 2-watershed villages, Bhimgadh and Laurali is in the range of 3.1 to 5 liters. In 5 villages, Kanera, Bhupgadh, Khicha, Padan and laiyari in the range of 5.1 to 7 liters. In Dedakadi village, milk yield is in the range of 7.1 to 9 liters. These numbers are significantly higher in 2004 when compared with the figures of 2003. In 2003, 7-watershed village had per day milk of 2.1-3 liters which is close to half of the milk produced by 6 watershed villages in 2004.

Control Village: In the control villages milk yield of cow has increased. In 2004, there are 4 villages, Ramadiya, Kalasar, Jaloya and Tal in which milk yield is in the range of 3.1 to 5 liters and in other 4 villages, Pisal, Veerpur, Kurunga and Thordi milk yield is in the range of 5.1 to 7 liters. In 2003 the situation was not good as 5 villages had daily milk yield in the range of 1-3 liters.

Average yield in	1999-2000		2000-01		2002-03		2003-04	
ltrs/day	WSD	NWSD	WSD	NWSD	WSD	NWSD	WSD	NWSD
0-1	2	0	2	0	0	0	0	0
1.1 to 2	0	4	0	4	0	1	0	0
2.1to 3	3	3	3	3	2	2	0	0
3.1 to 5	3	1	3	1	2	0	0	0
5.1 to7	0	0	0	0	4	5	0	0
7.1 to 9	0	0	0	0	0	0	4	7
Above 9.1	0	0	0	0	0	0	4	1

Table 8: Milk Yield (Buffaloes)

Milk yield of buffalos in watershed villages has improved more when compared with the control villages. There are 4 watershed villages milk yield is above 9 liters where as in 1 control village milk yield of buffalo is above 9 liters.

Watershed Village: Milk yield of buffaloes in watershed has risen in the year 2004 when compared to 2003. In 2003 in 4-watershed villages milk yield was in range of 5.1 to 7 liters. Where as in 2004, in 4 watershed villages, Khicha, Bhimgadh, Padan and Laiyari milk yield is in the range of 7.1 to 9 liters and in 4 watershed villages, Kanera, Bhupgadh, Laurali and Dedakadi milk yield is above 9 liters.

Control Village: In the control villages milk yield of buffalo has increased has increased similar to watershed villages. In 2003 in 5 control villages milk yield was in range of 5.1 to 7 liters. Where as in 2004, in all the 8 control villages milk yield is in the range of 7.1 to 9 liters.

Employment	1999-2000)	2000-01		2002-03		2003-04	
Status	WSD	NWSD	WSD	NWSD	WSD	NWSD	WSD	NWSD
Good (9 - 12 months)	1	0	0	0	2	0	3	0
Satisfactory (6 - 9 months)	0	2	4	0	0	1	3	2
Average (3 - 6 months)	3	2	0	0	2	3	2	6
Low (up to 3 months)	2	0	2	2	3	4	0	0
No employment	2	4	2	6	1	0	0	0

Table	9:	Local	Emp	loy	ment	within	the	village



The local employment is defined in terms of employment available with the village from agriculture and allied activities. Watershed village had more local employment opportunities within the village when compared to non-watershed village. The trend of employment opportunity is directly related to performance of agriculture. As the graphs on crop season and area has shown that watershed villages benefit with good rain and hence employment opportunities was showing increasing trend in the good monsoon year of 2003-04 when compared to non-watershed villages. In the year 2000-01 there were 4 watershed villages where employment opportunities has decreased in watershed villages and they are in the same level as non-watershed villages. The situation has significantly improved in 2003-04 as in 6 watershed villages employment was available for more than 6 months. When we compare with the non-watershed villages we find

that in 1999-2000 there were 2 villages where there was employment for more than 6 months, in 2000-01 in none of the non-watershed villages where there was employment for more than 6 months, in 2002-03 there were 1 nonwatershed villages where employment was available for 6months as this village could take additional rabi crop as it received good rain in spite of drought in other areas and in 2003-04 there were 2 non-watershed villages where employment was available for more than 6 months.

Watershed Village: Local employment scenario has improved in the watershed villages. In 2003, there was one watershed village where employment was not available within the village. In 3 villages employment availability was low. In 2004 there was no village where employment was not available. In 3 villages, employment availability was good as employment was available round the year and in 3 villages, employment availability was satisfactory as it was available for 6-9 months. In 2 villages, employment was available for 3-6 months as in both the villages farmers could only take limited crop in Rabi.

Control village: In the control village employment availability has improved a bit in comparison to 2003. In 2003, there was 1 control village where employment availability was satisfactory where as in 2004 there are 2 villages. In 6 villages, employment availability was average and in no village employment availability was low or not available.

Situation in watershed villages has improved significantly when compared with the control villages. In 3 watershed village's employment availability within the village was good where as in none of the control villages employment availability was good.

Migration	1999-2000		2000-01	2000-01			2003-04	
Scenario	WSD	NWSD	WSD	NWSD	WSD	NWSD	WSD	NWSD
No Migration.	2	0	0	0	1	1	3	2
Low Migration. (3 months)	3	0	0	0	2	1	4	2
Moderate Migration (3 - 6 month)	2	0	2	0	2	3	1	2
High Migration (6 - 9 month)	0	2	5	4	0	1	0	2
Very High Migration (more thane 9 month)	1	6	1	4	3	2	0	0

Table 10: Forced Migration



The above graph indicates the trend of migration in watershed and nonwatershed villages. Forced migration takes place generally when work within the village or surrounding areas are not available for more than 3 months. If that is the case then families are forced to migrate from the village. In this graph the idea is to show which villages has less migration. In 1999-2000, the first year of drought there were 3 watershed villages and 8 non-watershed villages from where villagers migrated for more than 3 months. In 2000-01 in the second year of drought the work available within the village was very low. In this year villagers from 8 watershed as well as 8 non-watershed villages rillagers migrated for more than 3 months. In the fourth year i.e. in 2002-03 of drought scarcity relief work was taken up on large scale in the drought affected villages. This helped in reducing the migration to some extent. Villagers from 6 watershed and 5 non-watershed villages migrated for more than 3 months. In the 2003-04 due to good monsoon situation in watershed villages improved significantly and as result villagers from one watershed village migrated and villagers from 4 non-watershed village migrated for more than 3 months.

Watershed Village: Migration is one of the indicators, which indicate that the villagers are in stress condition in drought years, and forced to migrate. In 2003 male from 3-watershed village had migrated for more than 3 months. In 2004 the situation is fairly good because in none of the watershed villages there was high or very high migration. There was no migration in 3 villages. In 4 villages, there low migration for upto 3 months that too for diamond cutting during the off seasons and in Bhimgadh village there was moderate migration by males for 3-6 months to work in bore well.

Control Village: Situation in the control village has not improved much. In 2003, male from 2 villages had migrated for more than 9 months, from 1 village had migrated for 6-9 months and from 3 villages had migrated for 3-6 months. Where as in 2004, there was no migration in 2 villages as agriculture work was available within the village. Villagers from Jaloya and Kalasar village migrated for 6-9 months as there no work within the village and from 2 villages, Pisal and Ramadiya migrated for 3-6 months.

Grains available	1999-2000)	2000-01		2002-03		2003-04	
for	WSD	NWSD	WSD	NWSD	WSD	NWSD	WSD	NWSD
Whole Year.	1	0	0	0	3	0	4	1
6 - 9 month (Low Shortage)	2	0	2	0	0	0	1	4
3 - 6 month (moderate Shortage)	5	7	1	0	0	4	2	2
1 - 3 month (High Shortage)	0	1	5	7	1	1	1	1
Grains bought throughout the year.	0	0	0	1	4	3	0	0

Table 11: Food Security

Food security has been understood in terms of the family's capacity to have food grains throughout the year. In the analysis not only food grains produced by the farmer is given importance but also the capacity of the family to purchase grains by selling off cash crops like groundnut and cotton is considered. Therefore in the table there are villages like Khicha where they grow cotton in Kharif but they sell off and earn money and this money they invest to purchase food crop which they can store for whole year.

Watershed Village: In 2004, food security in watershed village has improved a lot. In 2002-03 there were 4 villages in which grains were brought through out the year and in 1 village there was high grain shortage. In 2003-04 there was no village where grain was brought from outside the village. In Laiyari village there was high shortage as grain was available for 1-3 months only. In 2 villages, Lavrali and Padan there was moderate grain shortage and in Bhimgadh village there was low grain shortage. In 4 villages, Khicha, Kanera, Bhupgadh and Dedakadi grain was available throughout the year.

Control Village: In the year 2004, in the control village the situation has little bit improved when compared to 2003. In 2003 there were 3 villages in which grains had to be brought from outside, in 1 village there was high grain shortage and in 4 village there was moderate grain shortage. In 2004, in none of the control villages there was need to buy grain from outside the village. In Tal village there was high grain shortage, in 2 villages, Jaloya and Pisal there was moderate grain shortage, in 4 villages, Ramadiya, Veerpur, Kurunga and Thordi there was low grain shortage and in Kalasar village grain was available throughout the year. In Kalasar village farmers prefer growing millets and hence they get food grains through out the year.

Food security in the watershed villages is far better than the control villages. In 4 watershed village's grain was available throughout the year where as in 1 control village grain was available throughout the year within the village.

Conclusion and Recommendations

The purpose of the longitudinal study was to compare the situation of watershed village against another near by village without the advantage of watershed. The findings of the study have helped to project the trend in watershed as well as non-watershed village against the variation of rainfall. The impact of watershed on drought proofing has been measured by analyzing the data on 10 critical parameters. The finds have shown that in the first and second years of drought watershed village continue to enjoy advantage over non-watershed village. However in the fourth year of drought the watershed villages are not different from non-watershed villages and advantage enjoyed by watershed has been completely flattened. This was the finding from the last years study entitled "Advantage Declined". This has raised serious question on the impact of watershed programme on drought proofing in the fourth year of drought. In the year 2003-04 there was good timely monsoon and this has helped in water conservation in water harvesting structures. The picture which has emerged from this years study is that advantage enjoyed by watershed villages over nonwatershed villages has been regained by watershed villages and hence the title "Advantage Reclaimed". The watershed villages has performed exceptionally well in 6 parameters out of 10 studied parameters. The performance of watershed village in parameters like increase in crop area in Rabi, crops in 3 seasons, crop yield, employment opportunities within the village, fodder availability, food security and forced migration is significantly better than the nonwatershed villages. In case of food security it is found that in 4 out of 8 watershed villages, food is available throughout the year where as in one non-watershed village food is available throughout the year. The only major area of concern in watershed villages is that drinking water security has not been given adequate attention and hence watershed villages are not performing according to the desired level. The data analysis indicate that four watershed villages have drinking water availability throughout the year where as other four watershed villages face drinking water scarcity for more than 3 months. Discussion with the

villagers indicate that in most of the watershed villages drinking water security has not been given adequate attention in the initial planning and implementation. The other parameters that were studied were milk yield, change in cattle population, in these two parameters the performance of watershed and nonwatershed villages are same.

Some of the Recommendations are as follows:

- The watershed villages that have reclaimed the advantage quickly in all the 10 parameters need to be studied as best practice in watershed.
- The parameters that had helped in making these watershed successful need to found out and shared with others.
- The benefits of watershed from watershed need to be made sustainable for which a long term plan for livelihood enhancement should be drawn.
- Willage institutions need to be more empowered through capacity building so that they can themselves take the programme ahead by converging resources from other programme like Sawajaldhara for overall development of the village.

Annexure 1











