Study No.82

IMPACT EVALUATION OF NWDPRA IN MADHYA PRADESH

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PREFACE

Watershed is defined as a geo-hydrological unit or a piece of land that drains at a common point. It comprises of mainly three types of lands viz. arable, non arable and natural drainage lands. The watershed development involves conservation, improvement of land quality and water. It naturally needs coordination between the departments of agriculture, horticulture, forestry, veterinary and fishery.

This Centre undertook a study titled "Impact of National Watershed Development Project for Rainfed Areas (NWDPRA) – A Study in Raipur and Khargone districts of Madhya Pradesh" in 1995. The Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India desired that the impact of NWDPRA be reassessed in Raipur district of Madhya Pradesh.

As the title suggests the objective of the study was to evaluate the results of the working of the NWDPRA. For this purpose 50 beneficiary farmers in the catchment of the Silyarinala watershed and 25 non beneficiary farmers from out of the Silyarinala Watershed area were selected.

Among the conclusions reached the first was that Chetna Kendra established in the watershed area had a significant impact. Secondly, the dugwell irrigation/farm ponds helped the farmers to substitute low value crops by high value crops. Further, the overall development in NWDPRA Project helped increase in wage rate, employment, crop intensity, crop yields and thereby income of the beneficiaries. However, the programme did not show much progress in the non agricultural land development like planting of grasses, planting of nallah banks and afforestation. Also, programmes such as agro forestry, pasture development and dairying be given more attention.

It is suggested that there is a need for provision of funds for repairs of damaged structures, for revising financial ceilings and cost norms of components and arrangements for financing by banks to provide financial support to beneficiary farmers for the purchase of inputs. There is a need for a kind of flexibility in the allotment of funds to different components. Lastly it is suggested that there is a need for better coordination between different departments such as agriculture, horticulture, forestry, veterinary and

fishery. Such programmes can succeed only with full participation of people, particularly in the matters involving common property resources. Continuous monitoring and evaluation of the project by an independent agency is a must for timely solutions of problems.

The study would not have been possible without its initiation by the Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India and active coordination by the officials of the Directorate of Agriculture, Bhopal and officials of the Silyarinala watershed. I am thankful to all these officials. The day to day cooperation given by the officials of JNKVV is thankfully acknowledged. The patience with which the selected beneficiary and non beneficiary farmers offered information to our field staff is greatly appreciated.

Mr. K.G. Sharma, Research Officer and Officer in charge of the study painstakingly initiated, undertook field work, supervised tabulation and analysis and drafted the report. He was ably supported by Mr. J.R. Shinde and Mr. B.S. Patel, Research Investigators at all the stages of the study. Mr. C.K. Mishra, Computer shouldered the responsibility of tabulating the data and Mr. Sikandar Khan and Mrs. P. Awasthi did the computer typing work efficiently. Since such studies are joint efforts of many staff members, I thank all of them without mentioning their names.

I hope the study will help in improving the implementation of the NWDPRA Project.

Dated : 29.5.2001

(M.C. Athavale)
Professor & Head

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CHAPTER I

INTRODUCTION

1.1 The Watershed

Watershed is a geo-hydrological unit or a piece of land that drains at a common point. This natural unit is evolved through the interaction of rainwater with landmass and typically comprises of arable land, non-arable land and natural drainage lines in rainfed areas. Sustainable production depends on health, vitality and purity of production environment, of which, land and water are important constituents. Therefore, for scientific utilisation of the natural resource base of land and water, the ideal geographical unit would be the product of interaction of rain with land, i.e. the watershed.

1.2 Watershed Management

The watershed management focuses on conservation, use and improvement of land, water and other resources on a sustainable basis. It aims at slowing down or even reversing the run off and sedimentation of water resources. Its objective is to stop progressive removal of vegetative cover on non-arable lands. It seeks to control flooding from a large number of seasonal streams. To achieve these objectives National Watershed Development Project for Rainfed Areas (NWDPRA) was structured during VIII five year plan (1992-97) in each development block where less than 30 per cent arable area was under assured irrigation. The watershed development project was an integrated project involving close coordination of departments such as agriculture, horticulture, forestry, veterinary and fishery.

The approach of watershed development is followed since early sixties aiming at control of siltation in reservoirs or mitigation of floods. However, after announcement of the New 20 Point Programme in the year 1982, this approach was adopted as a national strategy for integrated and comprehensive development of rainfed areas. Emphasising the role of local area planning, "Approach to VII five year plan 1990-95" prepared by the Planning Commission highlighted the role of dry land farming including watershed development. This approach was further commended in the VIII five year plan (1992-93 to 1996-97).

1.3 Objectives of the NWDPRA

The objectives of project are :

(i) Conservation, upgradation and utilisation of natural endowments like land, water, plant, animal and human resources in a harmonious and integrated manner.

(ii) Generation of massive employment during the project period and regular employment after the project completion for enhancing the employment opportunities in the backward rainfed areas to ensure livelihood security particularly for under- previleged sections of the rural population like small and marginal farmers, landless labourers, tribals, etc.

(iii) Improvement of production environment and restoration of ecological balance through scientific management of land and rain water.

(iv) Reduction of inequalities between irrigated and rainfed areas. This will reduce large scale migration from rural areas to the cities.

(v) In addition to food, fuel and fodder the project would endeavour to enhance cash flow to the rainfed farmers and landless agricultural labourers through increased casual employment, marketable surplus of agricultural and dairy produce, growing of cash crops like vegetables, coriander, cumin, medicinal plants, etc. in suitable areas.

Thus, the ultimate objective of this project is to develop the natural resource base, sustain its productivity, improve the standard of living of millions of poor farmers and landless labourers and endeavour for restoration of ecological balance.

1.4 Sectors and Components of NWDPRA

The watershed development consisted of three physical sectors.

(i) Arable or cultivated lands which are privately owned,

(ii) Non arable lands which include village pastures and grazing grounds, culturable wastelands and barren and unculturable lands, and,

(iii) Network of natural drainage lines

These three sub sectors are hydrologically interspersed and would be treated as one organic geohydrological entity for project planning and implementation to ensure sustainable use of natural resources of land and water.

The project will treat the following sub components of the household farming systems.

(i) Food sub component
(ii) Fodder sub component
(iii) Fuel sub component, and,
(iv) Income generation component-household production system.

It is a totally Centrally Sponsored Scheme. The National Watershed Development Project for Rainfed Area (NWDPRA) was launched in VII five year plan covering 99 districts in 16 states.

1.5 This Study

The Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India desired that the impact of NWDPRA be reassessed in Raipur district of Madhya Pradesh by the Agro-Economic Research Centre, Jabalpur.

The idea is that the selected micro watershed sites should be revisited in order to see the effectiveness of the impact of various programme measures and project interventions on the economic and social parameters and to assess the long term impact of the project in mitigating the adverse effects in a sustainable manner.

The objectives of the study are:

(i) To examine the change in cropping pattern, crop sequencing and crop components under the production systems in arable lands.

(ii) To examine the change in overall biomass production in the forms of grasses, legumes, fodder, fuel wood, horti-plantation canopies in treated watershed against the control.

(iii) To examine the addition (numerically) of various forms of water bodies / water harvesting structures viz sunken dugouts, dug wells, recharge wells, farm ponds, run-off management structures etc. and the long term impact on water table in the dug wells / recharge wells.

(iv) To identify the improvement in socio-economic / income status of project beneficiaries against non-beneficiaries.

(v) To identify the status of migration of people, especially landless labourers and cattle from watershed to outside areas.

1.6 Sample Design

Agro-Economic Research Centre, Jabalpur already undertook the study titled "Impact of National Watershed Development Project for Rainfed Areas (NWDPRA) A study in Raipur and Khargone districts, Madhya Pradesh" in 1995. At the time of initiation of this study the Ministry of Agriculture, Govt. of India directed Agro-Economic Research Centre, Jabalpur to conduc

t the study in Seoni district of Madhya Pradesh.

However, subsequently the Ministry suggested that since this centre has already completed and submitted the study on Silyarinala watershed of Raipur district, the Centre should reassess the impact of NWDPRA in Raipur district. Therefore, the present study was conducted for Silyarinala watershed of Raipur district.

Raipur district belonged to the agro-climatic region "Chhattisgarh plains including Balaghat district". In the selected district, one watershed i.e. "Silyarinala " was selected and fifty beneficiaries and twenty five non-beneficiaries were selected earlier in 1995. The present study intends to collect data for same number of beneficiaries (50) and non-beneficiaries (25) from Silyarinala watershed of Raipur district. Beneficiaries were those whose farms and villages were located in the selected watershed area. The watershed had 8 villages of Mohbhata, Manohara, Motiyaridih, Lawar, Dhabadih, Devanpuri, Manikchori and Khargadih. Out of these, four villages were selected randomly in consultation with project officials, namely, Manohara, Lawar, Dhabadih and Khargadih. From these villages 50 beneficiaries were selected randomly. For the selection of non beneficiaries two villages located outside the watershed area were selected randomly in consultation with project officials. From these 25 non beneficiaries were selected randomly. The distribution of randomly selected beneficiaries and non beneficiaries is as follows (table 1.1 and table 1.2).

Table 1.1 Distribution of selected beneficiaries and non beneficiaries according to size of operational holdings, Silyarinala watershed, Raipur district, Madhya Pradesh

Size of operational holdings (hectares)	Beneficiaries	Non beneficiaries
Landless	03	02
Less than 1.00	08	05
1.00 - 2.00	10	04
2.00 - 4.00	12	06
4.00 – 10.00	11	06
10.00 & above	06	02
Total	**50**	**25**

Table 1.2 Distribution of selected beneficiaries and non beneficiaries according to villages, Silyarinala watershed, Raipur district, Madhya Pradesh

Villages	Beneficiaries	Non beneficiaries
Watershed area		
Manohara	11	--
Lawar	13	--
Dhabadih	16	--
Khargadih	10	--
Outside watershed area		
Lingadih	--	13
Khapari	--	12
Total	50	25

1.7 Reference Year

The analysis pertained to the data for the year 1999-2000 for selected beneficiaries and non-beneficiaries. The secondary data was collected for the period 1990-91 to 1997-98.

1.8 Data Collection

For the study both primary and secondary data were collected and analysed. Primary data were collected by interviewing the selected beneficiaries and non beneficiaries in their respective villages. Secondary data included data collected from various offices at the state level, district level, block level and watershed level.

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CHAPTER – II

RAIPUR DISTRICT

As mentioned earlier Raipur district was selected for the study. Raipur district was located in the south east corner of the state in the agro-climatic sub region "Chhattisgarh Plains including Balaghat district". A brief description of the selected district will be useful to understand the agro-climatic conditions prevailing therein.

It may be mentioned that in the process of reorganisation of districts erstwhile Raipur district was recently bifurcated into three districts: Raipur, Mahasamund and Dhamtari. However, the present description of Raipur district pertains to erstwhile undivided Raipur district for two reasons : Firstly, the secondary data on all aspects of agriculture is not available for the newly carved three districts, and secondly, Silyarinala watershed the watershed in question, incidentally, comes under old Raipur district and in the newly formed Raipur district again.

2.1 Location

Raipur, the second largest district of the State in respect of population and third largest in area was situated in the south eastern part of Madhya Pradesh between latitudes 19^{o} 50'N and 21^{o} 53'N and longitudes 81^{o} 25' and 83^{o} 38'E. The area of the district was 21,274 sq.km.

The district was bounded on the north by Bilaspur and Raigarh districts of Madhya Pradesh, in the east by Kalahandi and Sambalpur districts of Orissa State, in the south by Koraput district of Orissa State and by Bastar district of Madhya Pradesh and in the west by Durg district of Madhya Pradesh.

2.2 Topography

The district was divided into two more or less distinctly marked tracts by the river Mahanadi which flowed through the district from south west to north east. The country to the west of the Mahanadi comprising about half of Baloda Bazar tehsil, the whole of Raipur tahsil and a small area of Dhamtari tahsil, constituted a part of the open Chhattisgarh plain, thickly populated and closely cultivated. The character of the open country lying to the east of river Mahanadi was different. This trans Mahanadi area was hilly. Black soil was rare and yellow and red soils prevailed.

2.3 Climate and Rainfall

The climate of Raipur district was in general, warm and humid. Poorly wooded areas, the closeness of rocks to the surface and the red gravelly soil made the heat in summer excessive in the northern and central parts of the district, the areas in the south

and east were not as hot because of sal forests. Winter months were not very cold in the plains but the forest areas were much cooler. December and May were coldest and hottest months respectively.

The district fell in the heavy rainfall belt of the State and the average annual rainfall was 1,385 mm. In the southern and south eastern parts of the district the rainfall was usually copious. The tract around Simga often suffered from scarcity of rainfall.

The rainy season was spread over 4 months: June, July, August and September and July was usually the rainiest month. October also had 25 to 65 mm. of rain but the next 3 months: November to January had only 25 mm. of rain and the remaining four months had about 50 mm. in all.

2.4 Agriculture

2.4.1 Size of Holdings

The district had 6,56,132 holdings occupying 9,98,623 hectares or an average size of 1.522 hectares. Marginal size holdings predominated accounting for more than half (55.91 per cent) of the total number of holdings. Small holdings accounted for 21.64 per cent of the total number. These two classes of holdings together accounted for 77.55 per cent of the holdings but occupied only 36.72 per cent of the area. On the other hand large holdings constituting 1.04 per cent of the total number occupied 11.33 per cent of the area.

This indicated the skewed distribution of holdings (Table 2.1).

Table 2.1 Number and area of holdings ,Raipur district ,Madhya Pradesh

Size of holdings	Number of holdings		Area of holdings	
	Number	**Percentage**	**Number**	**Percentage**
Below 1 hectare (Marginal)	3,66,881	55.91	1,64,377	16.46
1 to 2 hectares (Small)	1,41,966	21.64	2,02,349	20.26
2 to 4 hectares (Semi medium)	95,125	14.50	2,59,068	26.01
4 to 10 hectares(Medium)	45,362	6.91	2,59,760	26.01
10 hectares & above (Large)	6,798	1.04	1,13,069	11.33
Total	**6,56,132**	**100.00**	**9,98,623**	**100.00**

2.4.2 Soils

The local soil terminology was as follows-

1. Kanhar
2. Dorsa
3. Matasi
4. Bhata

The Kanhar was a black clay which was very retentive of moisture. As it was apt to suffer from water-logging it was a good soil for wheat but not for paddy. It was, however, capable of growing a second crop and from that point of view, was certainly the most valuable soil in the district. The Matasi was a yellow soil, not retentive of moisture, but with heavy rainfall, giving a far better outturn of paddy than any other soil. The Matasi could not grow a second crop and when unembanked was fit for little more than kodon and required long resting fallows. The Dorsa was a mixture of Kanhar and Matasi as the name itself suggested (Do meant two and rasa meant extracts). It was a good soil for paddy but gave only a moderate outturn of wheat or second crop.

The Bhata was a poor detritus of laterite, red in colour and containing numerous little pebbles. It did not have much consistency and hardly retained any moisture. With a heavy rainfall a crop of kodon could be grown over this but otherwise it was the poorest soil in the district.

2.4.3 Land Utilisation

Of the total geographical area of 15,19,359 hectares a little more than 60 per cent (62.73 per cent) was net area sown. The district had very little area under forest (10.47 per cent) and less than 10 per cent (9.53 per cent) area under permanent pastures and other grazing land (Table 2.2).

Table 2.2 Land Utilisation, Raipur district, Madhya Pradesh, 1997-98.

Particulars	Area (hectares)	Percentage to geographical area
Forest	1,59,036	10.47
Land under non-agricultural uses	1,48,414	9.77
Barren and unculturable land	17,623	1.16
Permanent pastures and other grazing land	1,44,739	9.53
Land under miscellaneous tree crops and groves	92	0.01
Culturable waste land	41,093	2.70
Old fallows	32,923	2.17
Current fallows	22,255	1.46
Net area sown	9,53,184	62.73
Geographical area	**15,19,359**	**100.00**

2.4.4 Cropping Pattern & Irrigated Crops

Paddy occupied 76.24 per cent of the cropped area of the district. 'Other' pulses, mainly teora or lathyrus, occupied 15.38 per cent. Among cereals wheat occupied 1.12 per cent and among pulses gram occupied 1.29 per cent. Among other crops only fruits and vegetables and linseed occupied more than 1 per cent.

Of the gross cropped area 38.10 per cent was irrigated. Of the irrigated cropped area 95.20 per cent was occupied by paddy. Wheat occupied 1.44 per cent and fruits and vegetables 1.97 per cent.

Paddy was irrigated to the extent 47.57 per cent and wheat, 48.97 per cent (Table 2.3).

Table 2.3 Cropping pattern and irrigated crops, Raipur district, Madhya Pradesh, 1997-98

Crop	Area (hectares)	Percentage to gross cropped area (%)	Irrigated area (hectares)	Percentage to total irrigated area (%)	Percentage of irrigated cropped area to cropped area (%)
Paddy	9,18,641	76.24	4,36,991	95.20	47.57
Wheat	13,495	1.12	6,608	1.44	48.97
Other cereals	16,339	1.36	101	0.02	0.62
Total cereals	9,48,475	78.72	4,43,700	96.66	46.78
Gram	15,485	1.29	1,137	0.25	7.34
Other pulses	1,85,379	15.38	750	0.16	0.40
Total pulses	2,00,864	16.67	1,887	0.41	0.94
Total foodgrains	11,49,339	95.39	4,45,587	97.07	38.77
Fruits & Vegetables	16,851	1.40	9,056	1.97	53.74
Other food Crops	2,694	0.22	1,938	0.42	71.94
Total food crops	11,68,884	97.01	4,56,581	99.46	39.06
Linseed	16,133	1.34	3	-	0.02
Other oilseeds	17,162	1.42	1,678	0.37	9.78
Total oilseeds	33,295	2.76	1,681	0.37	5.05
Other non-food crops	2,716	0.23	771	0.16	28.39
Total non-food crops	36,011	2.99	2,452	0.53	6.81
Gross cropped area	**12,04,895**	**100.00**	**4,59,033**	**100.00**	**38.10**

2.4.5 Sources of Irrigation

The main sources of irrigation were government canals which commanded as high as 81.36 per cent of the irrigated cropped area. Tanks commanded 5.82 per cent and wells, 4.06 per cent. Other sources had 3.29 per cent of cropped area under the command and tubewells, 5.47 per cent (Table 2.4).

Table 2.4 Sources of irrigation, Raipur district, Madhya Pradesh, 1997-98

Source	Irrigated area (hectares)	Percentage
Canals	3,56,593	81.36
Tanks	25,522	5.82
Tubewells	23,943	5.47
Wells	17,793	4.06
Others	14,422	3.29
Total	**4,38,273**	**100.00**

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CHAPTER III

PROFILE OF SILYARINALA WATERSHED

Raipur district had 14 development blocks and a NWDPRA watershed in each. Of the 14 watersheds Silyarinala watershed in Simga block during the VIII plan period had second largest geographical area and largest cultivated area. It was, therefore, selected for the study.

3.1 Physical Features of Silyarinala Watershed

3.1.1 Location

The watershed was situated at a distance of 60 km. north of Raipur town and 16 km. north of Simga, the block headquarters. The watershed was rectangular in shape. It came under Mahanadi basin. The watershed had 8 villages of Mohbhata, Manohara, Motiyaridih, Lawar, Dhabadih, Devanpuri, Manikchori and Khargadih. The slope of the watershed was from south to north.

The Silyarinala joined the Sheonath river.

3.1.2 Administration

The Department of Agriculture was the principal implementing agency, under the Chairmanship of Collector, Raipur.

The four sectors involved were –

1. Agriculture
2. Horticulture
3. Forestry, and,
4. Veterinary

In the agricultural sector the staff involved included Assistant Soil Conservation Officer, Agricultural Development Officer (Soil Conservation) termed "Team leader", Surveyor and Rural Agricultural Extension Officer.

In horticultural sector Horticultural Development Officer and Rural Agricultural Extension Officer were included.

In forestry sector Range Forest Officer and Forester were included. Veterinary sector had Veterinary Surgeon and Veterinary Field Officer.

3.1.3 Rainfall

The nearest raingauge station was located at Tilda, 8 km. away from the watershed. It was noted that in 12 out of 14 years the rainfall was more than 1,000 mm. It was highest in 1994-95 (1,605.10 mm.) and lowest (876.90 mm.) in 1998-99 (Table 3.1).

Table 3.1 Rainfall recorded at Tilda during 1986-87 to 1999-2000

Year	Rainfall (mm.)
1986-87	1,037.00
1987-88	930.00
1988-89	1,031.80
1989-90	1,265.10
1990-91	1,412.40
1991-92	1,100.70
1992-93	1,025.30
1993-94	1,105.10
1994-95	1,605.10
1995-96	1,090.80
1996-97	1,030.20
1997-98	1,353.20
1998-99	876.90
1999-2000	1,268.40

The groundwater availability was poor.

There was no water logging problem.

3.1.4 Population

The total population of the watershed increase from 9,211 in 1990-91 to 12,607 in 1996-97 or an increase of 36.87 per cent . Of the total population 31.81 per cent were children. The male population formed 33.95 per cent and female population 34.27 per cent. The respective percentages in 1990-91 were 37.11, 31.28 and 31.61 (Table 3.2).

Table 3.2 Population, Silyarinala watershed, Raipur district, Madhya Pradesh

Classification	1990-91		1996-97	
	Number	Percentage	Number	Percentage
Male	2,881	31.28	4,280	33.95
Female	2,912	31.61	4.317	34.24
Children	3,418	37.11	4,010	31.81
Total	9,211	100.00	12,607	100.00

3.1.5 Land Use

The total geographical area of the Silyarinala watershed was 3,151.633 hectares. The net sown area was 2,487.820 hectares in 1996-97 and 2,457.00 hectares in 1990-91. The effective project area in both the reference years was 3066.000 hectares, (Table 3.3).

Table 3.3 Land use classification, Silyarinal watershed, Raipur district, Madhya Pradesh

Particulars	1990-91	1996-97
Fallow land (current + old)	95.550	64.730
Forest	1.788	1.788
Pasture land	356.418	356.418
Land put to non-agril. Uses	523.840	504.940
Net area sown	2,457.000	2,487.820
Total geographical area	3,151.633	3,151.633
Effective project area	3,066.000	3,066.000

3.1.6 Land Holdings

The watershed had 1,138 holdings. Of these about 40.00 per cent were marginal and covered about 15.00 per cent of the area. Another 35.00 per cent were small and covered about 25.00 per cent of the area. The remaining 25.00 per cent had a holding size of 2 hectares and above but covered nearly 60.00 per cent of the area. Thus, the overall size of holdings was quite small (Table 3.4).

Table 3.4 Size of holdings, Silyarinala watershed, Raipur district, Madhya Pradesh.

Size of holdings	Number		Area	
(hectares)	Number	Percentage	Area (hect.)	Percentage
0-1	463	40.68	409.755	15.69
1-2	392	34.45	686.000	26.27
Above 2	283	24.87	1,515.827	58.04
Total	**1,138**	**100.00**	**2,611.582**	**100.00**

3.1.7 Soils

In Silyarinala watershed Matasi constitute 35.00 per cent and Kanhar 30.00 per cent. Dorsa formed 25.00 per cent and Bhata, 10.00 per cent (Table 3.5).

Table 3.5 Constitution of soils, Silyarinala watershed, Raipur district, Madhya Pradesh

Soil type	Percentage to total
Kanhar	30.00
Dorsa	25.00
Matasi	35.00
Bhata	10.00
Total	**100.00**

3.1.8 Cropping Pattern

In 1996-97 of gross cropped area of 2,580 hectares paddy formed largest percentage of 77.21. Other important crop was gram (6.75 per cent) and til (5.81 per cent). In 1990-91 also paddy was the most important crop constituting 86.73 per cent. Gram was second important crop with 3.35 per cent of the area. Linseed was third important crop with 2.58 per cent of the area which reduced to 1.20 per cent area in 1996-97 (Table 3.6).

Table 3.6 Cropping pattern, Silyarinala watershed, Raipur district, Madhya Pradesh

Crop	1990-91		1996-97	
	Area (hectares)	Percentage to gross cropped area	Area (hectares)	Percentage to gross cropped area
Kharif				
Paddy	1915	86.73	1992	77.21
Soybean	7	0.32	85	3.29
Arhar	54	2.45	70	2.71
Urad	16	0.72	4	0.16
Til	55	2.49	150	5.81
Rabi				
Wheat	30	1.36	58	2.25
Gram	74	3.35	174	6.75
Linseed	57	2.58	31	1.20
Safflower	-	-	15	0.58
Sunflower	-	-	1	0.04
Total	**2208**	**100.00**	**2580**	**100.00**

Among other features of cropping the notable are : 2,460 hectares under single cropped area, 872 hectares under double cropped area and 235 hectares irrigated area in 1996-97. The figures for the year 1990-91 were 2,428 hectares under single cropped area, 784 hectares under double cropped area and 147 hectares under irrigation. Thus single cropped area, double cropped area and area under irrigation increased from 1990-91 to 1996-97.

3.1.9 Productivity of Crops

In 1996-97, the productivity (yield per hectare) of paddy was 18.100 quintals. In 1990-91 it was 18.000 quintals or slightly lower than 1996-97. The yield per hectare of soybean was 19.200 quintals in 1996-97. It was 12.100 quintals in 1990-91. Thus there was an increase of 58.68 per cent. The yields of urad, arhar, til, wheat and gram also showed an increase in 1996-97 over 1990-91. However, there was decline in yield of moong and linseed during these years (Table 3.7).

Table 3.7 Productivity of important crops, Silyarinala Watershed, Raipur district, Madhya Pradesh

Crop	Yield per hectare in quintals	
	1990-91	1996-97
Paddy	18.000	18.100
Soybean	12.100	19.200
Urad	3.200	4.050
Arhar	2.600	3.800
Moong	3.200	2.600
Til	2.600	3.200
Wheat	5.200	8.400
Gram	4.800	7.900
Linseed	2.500	2.400

3.1.10 Implements and Machinery

Among implements and machinery tractors, threshers, diesel pumps and electric pumps were major. There seems to be growing mechanisation in the selected watershed. The number of tractors increased from 7 in 1990-91 to 13 in 1996-97. The number of diesel pumps increased from 4 to 10 and that of electric pumps from 5 to 22 during the same years. The number of dusters increased from 6 to 14 and the number of sprayers increased from 10 to 52 and the cultivators increased from 7 to 13 (Table 3.8).

Table 3.8 Implements and machineries, Silyarinala watershed, Raipur district, Madhya Pradesh

Implements / Machinery	Number	
	1990-91	1996-97
Tractor	7	13
M.B.plough	-	3
Seed drill	-	3
Cultivator	7	13
Thresher	2	2
Duster	6	14
Sprayer	10	52
Diesel pump	4	10
Electric pump	5	22

3.1.11 Livestock Population

The livestock population in 1990-91 was 2,650. It increased to 3,851 in 1996-97 or an increase of 45.32 per cent (Table 3.9).

Table 3.9 Livestock population, Silyarinala watershed, Raipur district, Madhya Pradesh

Livestock	1990-91		1996-97	
	Number	Percentage	Number	Percentage
Milch animals	1,005	37.92	1,207	31.34
Draught animals	556	20.98	695	18.05
Bulls	6	0.23	8	0.21
Goats	376	14.19	540	14.02
Sheep	312	11.77	395	10.26
Poultry	395	14.91	1,006	26.12
Total	2,650	100.00	3,851	100.00

The milk production which stood at 35,000 litres in 1990-91 increased to 65,000 litres in 1996-97. Similarly, fish production recorded an increase from 32.00 quintals in 1990-91 to 45.00 quintals in 1996-97.

3.2 Targets and Achievements of Expenditure of Silyarinala Watershed

On the completion of VII plan (1985-86 to 1989-90) there were two annual plans for 1990-91 and 1991-92. The VIII plan was from 1992-93 to 1996-97. The IX plan started from the year 1997-98 and would continue till 2000-2001. In the previous report

targets and achievements of expenditure for the two years of annual plans of 1990-91 and 1991-92 and first two years of VIII plan i.e. 1992-93 and 1993-94 were described. In the present report the targets and achievements of expenditure for all the items of the programme are described till the end of VIII plan i.e. till 1996-97 from the initiation year i.e. 1990-91. In the year 1997-98 expenditure was incurred only on establishment of nursery. The total expenditure therefore includes expenditure incurred from 1990-91 till 1997-98. The financial target for the entire period was Rs. 68.737 lakhs. The main thrust was on development of arable lands and shared 33.39 per cent of the total target amount. The next important item of target was basic activities and shared 32.79 per cent of the target amount. The third important item was the development of non-arable lands and had 14.85 per cent of the targeted amount for it. Drainage line treatment had 10.79 per cent of the total targeted amount and the livestock management had a share of 8.18 per cent of the targeted amount. Against the target amount of Rs. 68.737 lakhs. The achievement was Rs. 59.343 lakhs. Thus the target fell short by 13.67 per cent. The item wise achievement showed that in the case of conservation measures on non-arable land the target was fully achieved. Similarly drainage line treatment in the upper reaches received maximum attention as the achievement was 100.00 per cent. In drainage line treatment of middle reaches or lower reaches the achievement was nearly 100.00 per cent (99.91 per cent and 99.64 per cent respectively). In the case of development of arable lands the achievement was 91.55 per cent. In the sub sectors viz. Conservation measures and production system the achievement was 91.08 and 92.15 per cent. The achievement was comparatively lower for non arable lands (51.16 per cent). Although the percentage of achievement for conservation measures on non arable lands was 100.00 per cent, the percentage achievement for production system was lower (43.19 per cent) (Table 3.10).

Table 3.10 Financial targets and achievements, 1990-91 to 1997-98, Silyarinala watershed,Raipur district, Madhya Pradesh

(Unit -Rs. lakh)

Activities	Target		Achievement		Percentage of achievement to target
	Amount	Percentage	Amount	Percentage	
Basic activities	22.534	32.79	21.047	35.47	93.40
Arable lands	22.953	33.39	21.013	35.41	91.55
i)Conservation measures	12.936	18.82	11.782	19.85	91.08
ii)Production system	10.017	14.57	9.231	15.56	92.15
Non arable lands	10.207	14.85	5.222	8.80	51.16
i) Conservation measures	1.432	2.08	1.432	2.41	100.00
ii) Production system	8.775	12.77	3.790	6.39	43.19
Drainage line treatment	7.418	10.79	7.403	12.47	99.80
a) Upper reaches	1.568	2.28	1.568	2.64	100.00
b) Middle reaches	2.250	3.27	2.248	3.79	99.91
c) Lower reaches	3.600	5.24	3.587	6.04	99.64
Live stock management	5.625	8.18	4.658	7.85	82.81
Total	**68.737**	**100.00**	**59.343**	**100.00**	**86.33**

3.3 Financial Targets and Achievements for the Different Activities

In the following paragraphs financial targets and achievements for the different activities of the watershed have been described. As mentioned earlier the main activities were: Basic Activities, Arable Lands, Non Arable Lands, Drainage Line Treatment and Livestock Management. The description of Basic Activity follows.

3.3.1 Basic Activities

The main activities among basic activities were survey projectisation, nursery establishment, trainings etc. It is noted that the percentage of achievement for all the activities taken together to target was 93.40. Among the sub items the percentage was highest (99.99) for research activities. For establishment and management the percentage of achievement to target was 95.11. This was closely followed by training (94.41 per cent) and survey projectisation (93.36 per cent) respectively (Table 3.11).

Table 3.11 Financial target and achievement under Basic Activities, Silyarinala watershed, Raipur district, Madhya Pradesh

(Unit- Rs. lakh)

Activity	Target	Achievement	Percentage of achievement to target amount
Survey projectisation	2.800	2.614	93.36
Nursery establishment	2.664	2.148	80.63
Training	4.756	4.490	94.41
Establishment & management	3.620	3.443	95.11
Research	6.683	6.682	99.99
Innovative	2.011	1.670	83.04
Total	**22.534**	**21.047**	**93.40**

3.3.2 Arable Lands

Under this activity there were two sub activities : i) Conservation measures and ii) Production system. The performance of these in terms of targets and achievements are described below :

3.3.2.1 Conservation Measures

The percentage of achievement to target was quite high (91.08). Among the sub activities the percentage of achievement to target for contour vegetative hedges and repairs

of old filter strips. The achievement was nearly total for water distribution system (99.20 per cent) and gully control (99.69 per cent). For farm pond activities the percentage of achievement was 91.75.

3.3.2.2 Production System

In the overall production system activities the percentage of achievement was 92.15. Among the sub activities the percentage was 100.00 for crop demonstrations. It was nearly total (98.97 per cent) for household production system. For other sub activities such as household garden (96.00 per cent), organic farming system (93.22 per cent) and agro forestry (93.53 per cent), the performance was quite good (Table 3.12).

Table 3.12 Financial targets and achievements under arable land development, Silyarinala watershed, Raipur district, Madhya Pradesh

(Unit – Rs. lakh)

Activity	Target	Achievement	Percentage of achievement to target amount
Conservation measures			
i) Contour vegetative hedges	0.536	0.536	100.00
ii) Water distribution system	0.500	0.496	99.20
iii) Repairs of old soil conservation filter strips	0.050	0.050	100.00
iv) Gully control	1.300	1.296	99.69
v) Recharge of wells dead furrow, contour cultivation	0.300	--	--
vi) Other activity (Farm pond)	10.250	9.404	91.75
Total of conservation measures	**12.936**	**11.782**	**91.08**
Production System			
i) Crop demonstration	4.421	4.421	100.00
ii) Agro-forestry	0.750	0.679	90.53
iii) Dry land horticulture	1.500	0.883	58.87
iv) Organic farming system (Compost pit)	0.796	0.742	93.22
v) Homestead garden	0.600	0.576	96.00
Vi) Household production system	1.950	1.930	98.97
Total of production system	10.017	9.231	92.15
Total	22.953	21.013	91.55

3.3.3 Non Arable Lands

In the non arable land development activities are two major activities viz. conservation measures and production system.

3.3.3.1 Conservation Measures

The figures for targets and achievements for various activities under conservation measures showed that total funds allotted on all items were utilised. In other words the achievement was 100.00 per cent for live fencing, gully control measures and gabian structures.

3.3.3.2 Production System

Among the production system activities planting of shrubs and planting of trees received maximum attention so that the entire amount targeted was fully utilised indicating 100.00 per cent achievement. In the case of over seeding of grasses for pasture development the percentage of achievement was nearly total (99.40 per cent). However, very little was done on the activity of water harvesting tank wherein the achievement was only one third of the targeted amount (33.57 per cent) (Table 3.13).

Table 3.13 Financial targets and achievements under non arable land development, Silyarinala watershed, Raipur district, Madhya Pradesh

(Unit – Rs. lakh)

Activity		Target	Achievement	Percentage of achievement to target amount
Conservation measures				
i)	Live fencing	0.500	0.500	100.00
ii)	Vegetative contour hedges	0.432	0.432	100.00
iii)	Gabian structures	0.500	0.500	100.00
Total of conservation measures		**1.432**	**1.432**	**100.00**
Production system				
i)	Over seeding of grasses for pasture development	0.500	0.497	99.40
ii)	Water harvesting tank	7.500	2.518	33.57
iii)	Planting of shrubs	0.400	0.400	100.00
iv)	Planting of trees	0.375	0.375	100.00
Total of production system		**8.775**	**3.790**	**43.19**
Total		**10.207**	**5.222**	**51.16**

3.3.4 Drainage Line Treatment

In the soil and water conservation measures the drainage line is treated at three areas viz. upper reaches, middle reaches and lower reaches. In the upper reaches of drainage line mainly check dams are constructed. In addition sunken ponds are also created. In the activity of upper reaches the targeted amount is Rs.1.068 lakhs. The entire amount planned was spent for the purpose showing that the achievement percentage to target was 100.00. Among the middle reaches line treatment measures of loose boulder

structures, earthen structure and dugout ponds were created. In this group of activity also the achievement was nearly total (99.91 per cent). In the activity of loose boulder structures and dugout ponds the achievement was 100.00 per cent.

Among the lower reaches activities are : limited number of dugout structures and removal of nala congestion. On these activities also nearly entire amount earmarked was utilised giving the percentage of achievement to total to be 99.50 and 99.81 respectively (Table 3.14).

Table 3.14 Financial targets and achievements under drainage line treatment, Silyarinala watershed, Raipur district, Madhya Pradesh

(Unit – Rs. lakh)

Activity	Target	Achievement	Percentage of achievement to target amount
Bank stabilisation	0.500	0.500	100.00
Upper reaches			
i) Live check dams	0.036	0.036	100.00
ii) Brushwood check dams	0.097	0.097	100.00
iii) Loose boulder check dams	0.500	0.500	100.00
iv) Small dugout/sunken ponds	0.435	0.435	100.00
Total	1.068	1.068	100.00
Middle reaches			
i) Loose boulder structures	0.500	0.500	100.00
ii) Earthen structures	1.000	0.998	99.80
iii) Runoff management dugout ponds	0.750	0.750	100.00
Total	2.250	2.248	99.91
Lower reaches			
i) Limited no.of dugout structures	2.000	1.990	99.50
ii) Removal of nala congestion & others	1.600	1.597	99.81
Total	3.600	3.587	99.64
Total drainage line treatment	7.418	7.403	99.80

3.3.5 Livestock Management

This activity was closely related with the overall watershed development. The proposed activities were castration of scrub bulls, natural breeding and cultivated fodder production. The total amount earmarked for all the three activities taken together was Rs.5.625 lakhs. Against this the amount actually spent was Rs.4.658 lakhs or 82.81 per cent of the targeted amount. There was some variation among the three activities so that in the case of natural breeding activity 100.00 per cent achievement was noticed. In the case of castration of scrub bulls activity the achievement was nearly total or 98.00 per cent. In the third activity of cultivated fodder production, however, the achievement was bit lower i.e. 80.76 per cent (Table 3.15).

Table 3.15 Financial targets achievements under Livestock Management, Silarinala watershed, Raipur district, Madhya Pradesh.

(Unit – Rs. lakh)

Activity	Target	Achievement	% of achievement to target amount
Castration of scrub bulls	0.250	0.245	98.00
Natural breeding and other means of population control.	0.375	0 375	100.00
Cultivated fodder production	5.000	4.038	80.76
Total	**5.625**	**4.658**	**82.81**

It is noted that the percentage of achievements of expenditure to targets for most of the programmes was quite satisfactory and in most of the cases, more than 90.00 per cent. In the case of programme for development of non arable lands the percentage of achievement of expenditure to target was 51.16. In this programme the percentage of achievement to target for conservation measures was 100.00. However, the achievement for production system was only 43.19 per cent. Among different programmes the percentage of achievement for livestock management was comparatively lower (82.81). Among livestock programmes the cultivated fodder production system programme did not do well as the percentage of achievement to target was 80.76.

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CHAPTER IV

IMPACT OF NWDPRA PROGRAMME IN SILYARINALA WATERSHED

4.1 Characteristics of and Impact on Selected Beneficiaries.

In the Silyarinala watershed 50 beneficiaries and 25 non beneficiaries were selected. Beneficiaries were those whose farms and villages were located in the selected watershed area. Non beneficiaries were those whose farms and villages were located outside the watershed area.

4.1.1 Distribution of Beneficiaries According to Benefits.

Of the 50 beneficiaries 32.00 per cent were those who received saplings of various trees. Eighteen per cent beneficiaries received saplings along with irrigation pipes. Another 10.00 per cent received poultry birds. Eight per cent each received saplings along with weedicides and help in Nadef construction plus demonstrations and saplings, poultry birds, irrigation pipes plus grain bins (Table 4.1).

Table 4.1 Distribution of beneficiaries according to types of benefits received, Silyarinala watershed, Raipur district, Madhya Pradesh

Type of benefit	No. of beneficiaries
Saplings	16
Saplings + Irrigation pipes	9
Poultry	5
Saplings + Weedcides	4
Saplings + Nadef construction + Demonstration	4
Saplings + Poultry + Irrigation pipes + Grain bin	4
Sapling + Farm pond + Nadef constrution + Poultry	3
Farm pond + Poultry + Irrigation pipes + Grain bin	3
Sapling + Farm pond + Nadef construltion +Irrigation pipes	2
Total	**50**

4.1.2 Occupational Distribution

Of the various occupations agriculture was the most important as 57.43 per cent workers were engaged in it. Another 14.87 per cent were engaged in household works. Slightly more than 17 per cent able bodied persons had no formal occupation (Table 4.2).

Table 4.2 Distribution of workers according to occupation beneficiary families, Silyarinala watershed, Raipur district, Madhya Pradesh

Main occupation	Males		Females		Total	
	No.	Percentage	No.	Percentage	No.	Percentage
No occupation	25	18.38	18	15.93	43	17.27
Agriculture	94	69.11	49	43.36	143	57.43
Agril. labour	2	1.47	2	1.77	4	1.61
Non-agril. labour	2	1.47	5	4.43	7	2.81
Household work	-	-	37	32.74	37	14.87
Service	5	3.67	2	1.77	7	2.81
Lohari	1	0.74	-	-	1	0.04
Kumhari	1	0.74	-	-	1	0.04
Betal shop	2	1.47	-	-	2	0.80
Cycle store	2	1.47	-	-	2	0.08
Kirana shop	1	0.74	-	-	1	0.40
Others	1	0.74	-	-	1	0.40
Total	**136**	**100.00**	**113**	**100.00**	**249**	**100.00**

Among non beneficiaries 39.26 per cent workers had agriculture as occupation. Slightly more than 30 per cent of the workers were engaged in household works, 16.83 per cent had no formal occupation and 6.54 per cent had agricultural labour as the main occupation (Table 4.3).

It is thus observed that the occupation distribution of beneficiaries and non beneficiaries was not different.

Table 4.3 Distribution of workers according to occupation, non beneficiary families, Silyarinala watershed, Raipur district, Madhya Pradesh

Main occupation	Male		Female		Total	
	No.	%	No.	%	No.	%
No occupation	10	18.87	8	14.82	18	16.83
Agriculture	33	62.27	9	16.67	42	39.26
Agril. labour	6	11.32	1	1.85	7	6.54
Non-agril. labour	-	-	2	3.70	2	1.87
Household work	-	-	34	62.96	34	31.76
Kirana shop	2	3.77	-	-	2	1.87
Carpentry	2	3.77	-	-	2	1.87
Total	**53**	**100.00**	**54**	**100.00**	**107**	**100.00**

4.1.3 Land Particulars

The operated area of 50 beneficiaries was 160.73 hectares or 3.21 hectares per beneficiary. The operated area per non beneficiary was 1.66 hectares or half of the beneficiary farms. The gross cropped area of the beneficiary farms was 189.30 hectares. This means that the cropping intensity was 117.77 per cent .On the non beneficiary farms the cropping intensity was 107.10 per cent (Table 4.4).

Table 4.4 Land utilisation pattern of beneficiary and non beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh.

(Unit - hectare)

Particulars	Beneficiary	Non beneficiary
Total land	142.51	37.80
Leased in land	24.57	6.58
Cultivable waste land	6.35	2.83
Operated area	160.73	41.55
Net area sown	160.73	41.55
Area cropped more than once	28.57	2.95
Gross cropped area	189.30	44.50
Cropping intensity (%)	117.77	107.10

4.1.4 Sources of Irrigation

The net irrigated area of the beneficiary farms was 81.97 hectares and the gross irrigated area was 107.81 hectares. Thus the irrigation intensity was 131.52 per cent. On the non beneficiary farms the irrigation intensity was 134.17 per cent. On both beneficiary and non beneficiary farms wells/tube wells were the main sources of irrigation. While the contribution of wells / tube wells on beneficiary farms was 59.29 per cent that on non beneficiary farms was 55.91 per cent .Farm ponds were sources of irrigation only on beneficiary farms as these qualified the beneficiary farms to be so being the main activity of the watershed. Percentage of area commanded by tanks and nallahs was higher on non beneficiary farms (Table 4.5).

Table 4.5 Area under irrigation of beneficiary and non beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

(Unit -hectare)

Particulars	**Beneficiary**	**Non beneficiary**
Irrigated area by wells/tube wells	48.60 (59.29)	4.45 (55.91)
Irrigated area by other sources		
Farm ponds	6.97 (8.50)	--
Tanks	11.27 (13.75)	1.62 (20.35)
Nallahs	15.13 (18.46)	1.89 (23.74)
Total	**81.97** **(100.00)**	**7.96** **(100.00)**
Net irrigated area	81.97	7.96
Area irrigated more than once	25.84	2.72
Gross irrigated area	107.81	10.68
Irrigation intensity (%)	131.52	134.17

The number of families having wells / tubewells increased from 10 to 19 in the post project period among the beneficiaries and the same increased from 2 to 3 among the non beneficiaries. This shows that percentage increase in number of farm wells is much higher for watershed region. The beneficiary households, though a few in number (8), prepared sunken farm ponds to store the run off rain water.

Nearly 30 per cent beneficiary households reported that due to watershed treatment, the water table of the wells / tubewells increased by 0.31 to 0.92 metre in the average monsoon year. Nearly 20 per cent reported marginal increase in water table of the wells / tubewells. However, recharging rate and subsequent increase in water table depends much on the frequency and intensity of rainfall (Table 4.6).

Table 4.6 Number of wells, tubewells and farm ponds, beneficiary and non beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

Particulars	Beneficiary		Non beneficiary	
	Pre project	Post project	Pre project	Post project
Wells / Tubewells				
Number	10	19	2	3
Percentage increase	--	190.00	--	150.00
Farm ponds				
Number	--	8	--	--

4.1.5 Cropping Pattern

Cropping pattern of the beneficiary and non beneficiary farms was studied at two points of time : pre project and post project. In the case of beneficiary farms although paddy was the most important crop, its proportion in the gross cropped area got reduced by about 6.00 per cent in the post project year against the pre project year. On the other hand the post project year's cropping pattern showed increase over pre project cropping pattern in the cases of crops like wheat, gram, soybean, vegetables and fruits. Thus the proportion of area in the post project year increased in commercial crops. Another feature was percentage increase in the area under improved varieties of paddy in the post project year. In the case of non beneficiary farms although the percentage of area under paddy increased by about 2.00 per cent in the post project year, the proportion under improved paddy was more than double than that of pre project year. In the case of other crops there was no significant difference (Table 4.7).

Table 4.7 Cropping pattern of beneficiary and non beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

(Figures - per cent to gross cropped area)

Crop	Beneficiaries			Non Beneficiaries		
	Pre	Post	3-2	Pre	Post	6-5
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Kharif						
Paddy improved	24.69	45.78	21.09	28.31	64.50	36.19
Paddy local	36.97	10.02	(-)26.95	45.75	12.00	(-)33.75
Total paddy	**61.66**	**55.80**	**5.86**	**74.06**	**76.50**	**2.44**
Maize	0.77	0.64	(-)0.13	-	-	-
Kodo-kutki	3.70	1.08	(-)2.62	2.26	0.45	(-)1.81
Moong	0.31	0.21	(-) 0.10	-	-	-
Urad	0.37	0.21	(-) 0.16	-	-	-
Arhar	0.50	0.21	(-) 0.29	3.85	1.83	(-) 2.02
Groundnut	0.81	0.43	(-) 0.38	-	-	-
Soybean	1.38	3.99	2.61	3.51	4.08	0.57
Til	0.49	0.43	(-) 0.06	-	-	-
Total kharif	**69.99**	**63.00**	**(-) 6.99**	**83.68**	**82.86**	**(-) 0.82**
Rabi						
Wheat	9.54	9.98	0.44	6.80	7.46	0.66
Gram	8.32	8.52	0.20	1.13	1.30	0.17
Teora	7.08	6.62	(-) 0.46	6.23	5.89	(-) 0.34
Batri	1.35	1.22	(-) 0.13	1.59	1.37	(-) 0.22
Linseed	0.83	-	(-) 0.83	-	-	-
Total rabi	**27.12**	**26.34**	**(-) 0.78**	**15.75**	**16.02**	**0.27**
Annual & perennial crops						
Vegetables	2.89	5.31	2.42	0.57	1.12	0.55
Fruits	-	5.35	5.35	-	-	-
Total annual & perennial crops	**2.89**	**10.66**	**7.77**	**0.57**	**1.12**	**0.55**
Total	**100.00**	**100.00**	**-**	**100.00**	**100.00**	**-**

4.1.6 Irrigated Crops

The irrigated crops were maize, groundnut, soybean, wheat, gram, vegetables and fruits. In the case of maize, groundnut, soybean, vegetables and fruits the entire cropped area was irrigated in the post project year. Wheat was irrigated to the extent of 94.00 per cent. Gram was irrigated to the extent of 67.42 per cent and paddy, 45.84 per cent. A comparison of the irrigated cropped area in the post project year with that of pre project year showed that maize, groundnut, soybean and vegetables were entirely irrigated in the pre project year also. In the case of wheat and gram there was an increase in the percentage of cropped area from pre project year to post project year. In the case of paddy also the percentage of irrigated area (45.84) was higher than pre project year (33.94) (Table 4.8).

Table 4.8 Irrigated cropped area, beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

(Unit- hectare)

Crop	Pre project			Post project		
	Cropped area	Irrigated area	Percentage of irrigated area to cropped area	Cropped area	Irrigated area	Percentage of irrigated area to cropped area
Kharif						
Paddy improved	40.10	20.00	49.88	86.09	44.62	51.83
Paddy local	60.06	14.00	23.31	18.97	3.54	18.86
Total paddy	**100.00**	**34.00**	**33.94**	**105.06**	**48.16**	**45.84**
Maize	1.25	1.25	100.00	1.21	1.21	100.00
Kodo-kutki	6.00	-	-	2.07	-	-
Moong	0.50	-	-	0.40	-	-
Urad	0.60	-	-	0.40	-	-
Arhar	0.81	-	-	0.40	-	-
Groundnut	1.31	1.31	100.00	0.81	0.81	100.00
Soybean	2.25	2.25	100.00	8.09	8.09	100.00
Til	0.80	-	-	0.81	-	-
Total kharif	**113.68**	**38.81**	**34.14**	**119.25**	**58.25**	**48.86**
Rabi						
Wheat	15.50	13.00	83.87	16.99	15.97	94.00
Gram	13.50	6.50	48.15	14.24	9.60	67.42
Teora	11.50	-	-	12.54	-	-
Batri	2.20	-	-	2.31	-	-
Linseed	1.35	-	-	-	-	-
Total rabi	**44.05**	**19.50**	**44.27**	**46.08**	**25.57**	**55.49**
Annual & perennial crops						
Vegetables	4.70	4.70	100.00	13.85	13.85	100.00
Fruits	-	-	-	10.12	10.12	100.00
Total annual & perennial crops	**4.70**	**4.70**	**100.00**	**23.97**	**23.97**	**100.00**
Total	**162.43**	**63.01**	**38.79**	**189.30**	**107.81**	**56.95**

In the case of non beneficiary farms wheat and vegetables were fully irrigated in both pre project and post project years. In the case of gram the percentage of irrigated area was 40.00 in pre project year. It increased to 100.00 per cent in the post project year. In the case of paddy, however, the percentage of irrigated area got reduced in the post project year as compared to pre project year. This was true for both improved and local varieties (Table 4.9).

Table 4.9 Irrigated cropped area, non beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

(Unit- hectare)

Crop	Pre project			Post project		
	Cropped area	Irrigated area	Percentage of irrigated area to cropped area	Cropped area	Irrigated area	Percentage of irrigated area to cropped area
Kharif						
Paddy improved	12.50	4.25	34.00	28.70	5.88	20.49
Paddy local	20.20	2.20	10.89	5.34	0.40	7.49
Total paddy	**32.70**	**6.45**	**19.72**	**34.04**	**6.28**	**18.45**
Kodo-kutki	1.00	-	-	0.20	-	-
Arhar	1.70	-	-	0.81	-	-
Soybean	1.55	-	-	1.82	-	-
Total kharif	**36.95**	**6.45**	**17.46**	**36.87**	**6.28**	**17.03**
Rabi						
Wheat	3.00	3.00	100.00	3.32	3.32	100.00
Gram	0.50	0.20	40.00	0.58	0.58	100.00
Teora	2.75	-	-	2.62	-	-
Batri	0.70	-	-	0.61	-	-
Total rabi	**6.95**	**3.20**	**91.43**	**7.13**	**3.90**	**54.70**
Annual & perennial crops						
Vegetables	0.25	0.25	100.00	0.50	0.50	100.00
Total annual & perennial crops	**0.25**	**0.25**	**100.00**	**0.50**	**0.50**	**100.00**
Total	**44.15**	**9.90**	**22.42**	**44.50**	**10.68**	**24.00**

4.1.7 Crop Sequence

A change in crop sequence was noticed from pre project to post project year. While there was not much variation in the cultivation of single crop of paddy or kodo-kutki variation was noticed in crop sequence of paddy- teora so that teora was replaced by vegetables. In the cropping sequence with soybean crop the change was such that in rabi season apart from wheat and gram, vegetables were grown. Another change was that instead of usual food grains, fruits were grown (Table 4.10).

Table 4.10 Crop sequence followed by beneficiary and non beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

Pre project	Post project
Paddy	Paddy
Paddy – Teora	Paddy – Vegetagles – Vegetables
Paddy – Wheat /Gram / Batri / Linseed	Paddy – Wheat /Gram / Batri / Linseed / Teora
Kodo kutki	Kodo kutki
Urad, Moong and Arhar	Urad, Moong and Arhar
Maize – Wheat / Gram / Teora	Maize – Wheat / Gram / Teora
Til - Batri / Teora	Til - Batri / Teora
Groundnut - Wheat / Gram	Groundnut - Wheat / Gram
Soybean - Wheat / Gram	Soybean - Wheat / Gram Soybean - Vegetables - Vegetables
No Crop	Fruits

4.1.8 Cropping System

Mixed cropping and inter cropping are practised by the farmers of rainfed area to guard against failure of crops in the case of water stress or insect or pest attacks. The idea is that atleast one of the crops would be saved. With the development of watershed the water is partly assured and therefore a farmer can take the risk of taking a sole crop. Our observations showed that in the case of beneficiary farms the percentage of farmers practising sole cropping increased from 44.00 to 68.00 in the post project year. The percentage of farmers among non beneficiaries was 26.00 and 38.00 respectively. Conversely the percentage of beneficiary farms adopting mixed farming decreased from 54.00 to 42.00 and that for non beneficiary farms decreased from 40.00 to 36.00. Similar situation was noticed in the case of inter cropping (Table 4.11).

Table 4.11 Cropping system followed by beneficiary and non beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

(Figures in percentage)

Type of cropping	Beneficiary		Non beneficiary	
	Pre project	Post project	Pre project	Post project
Sole cropping	44.00	68.00	26.00	38.00
Mixed cropping	54.00	42.00	40.00	36.00
Inter cropping	22.00	14.00	16.00	8.00

4.1.9 Productivity of Crops

It was observed that the number of crops grown by beneficiary farmers was more than the non beneficiary farmers. Maize, urad, moong, groundnut, til and linseed were not at all grown by non beneficiary farmers. It was also noted that there was an increase from pre project yield to post project yield in most of the crops. The increase in the case of beneficiary farmers was 17.10 per cent for improved paddy, 21.62 for local paddy, 10.24 per cent for maize and 33.04 per cent for kodo-kutki. Batri recorded highest percentage increase (36.17) followed by moong (34.77). In the case of non beneficiary farmers the increase in yield from pre project to post project period was 27.62 per cent in improved paddy, 23.62 per cent in local paddy and 42.31 per cent in kodo-kutki. Teora and batri recorded 36.79 per cent and 34.85 per cent increase from pre project to post project year respectively. A comparison of yield between beneficiary and non beneficiary farmers indicated that in the case of paddy local, kodo-kutki, arhar and teora the yield on non beneficiary farms was more than the beneficiary farms. In the case of paddy improved, wheat, gram, batri and soybean the increase in yield was more on the beneficiary farms (Table 4.12).

Table 4.12 Productivity of different crops selected beneficiary and non beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

(Unit - kg./ hectare)

Crop	Beneficiary farm			Non beneficiary farm		
	Pre project	Post project	Percentage over pre project	Pre project	Post project	Percentage over pre project
Paddy improved	1,164	1,363	17.10	1,050	1,340	27.62
Paddy local	851	1,035	21.62	868	1,073	23.62
Maize	781	861	10.24	-	-	-
Kodo kutki	115	153	33.04	130	185	42.31
Moong	256	345	34.77	-	-	-
Urad	270	330	22.22	-	-	-
Arhar	785	595	(-) 24.20	661	6.97	5.45
Groundnut	873	988	13.17	-	-	-
Soybean	785	980	24.84	756	928	22.75
Til	139	165	18.71	-	-	-
Wheat	873	1,148	31.50	868	1,120	29.03
Gram	472	570	20.76	462	543	17.53
Teora	208	250	20.19	193	264	36.79
Batari	282	384	36.17	264	356	34.85
Linseed	128	-	-	-	-	-

4.1.10 Profitability of Crops

The five important crops on the selected farms were paddy, wheat, gram, teora and soybean. The profitability of these crops has been compared for beneficiary and non beneficiary farms. On beneficiary farms the profit per hectare for paddy for improved varieties was Rs.8,389. It was about Rs.3,700 more than the local varieties. The profit per hectare for wheat varieties was Rs.4,080 and that for gram, teora and soybean Rs.3,983, Rs.1,648 and Rs.7,509 respectively. The profit per hectare for all the five crops was higher in the post project year than the pre project year (Table 4.13).

Table 4.13 Profitability of crops, selected beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

(Value- Rs. /hectare)

Crop	Output			Input			Net profit		
	Pre project	Post project	% over pre project	Pre project	Post project	% over pre project	Pre project	Post project	% over pre project
Paddy improved	9,076	12,162	38.95	3,060	3,773	23.30	6,016	8,389	39.44
Paddy local	6,034	8,281	37.24	2,621	3,650	39.26	3,413	4,631	35.69
Wheat	5,715	7,744	35.50	2,865	3,664	27.89	2,850	4,080	43.16
Gram	5,773	7,245	25.50	2,652	3,262	23.00	3,121	3,983	27.62
Teora	2,224	2,655	19.38	801	1,007	25.72	1,423	1,648	15.89
Soybean	8,339	11,743	40.82	3,113	4,234	36.01	5,226	7,509	43.69

On the non beneficiary farms profit per hectare for improved paddy varieties was Rs.8,362 and that for local varieties Rs.4,691. Thus the profitability for improved varieties of paddy on beneficiary farms was slightly higher than non beneficiary farms. Similarly profitability on beneficiary farms was higher than non beneficiary farms for wheat, gram and soybean (Table 4.14).

Table 4.14 Profitability of crops, selected non beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

(Value- Rs. /hectare)

Crop	Output			Input			Net profit		
	Pre project	Post project	% over pre project	Pre project	Post project	% over pre project	Pre project	Post project	% over pre project
Paddy improved	8,642	12,567	45.42	2,970	4,205	41.58	5,672	8,362	47.43
Paddy local	5,960	8,365	40.35	2,731	3,674	34.53	3,229	4,691	**45.28**
Wheat	5,612	7,685	36.94	2,795	3,735	33.63	2,817	3,950	40.22
Gram	5,620	7,022	24.95	2,570	3,186	23.97	3,050	3,836	25.77
Teora	2,185	2,687	22.97	796	1,020	28.14	1,389	1,667	20.01
Soybean	8,212	11,293	37.52	3,012	3,963	31.57	5,200	7,330	40.96

4.1.11 Sources of Income

The total income per household of beneficiary farms in the pre project year was Rs.18,617.00. It increased to Rs.39,609.00 in the post project year indicating more than double increase in income. In the case of non beneficiary farms the income per household increased from Rs.18,224.00 to Rs.32,400.00 or an increase of 77.79 per cent. As regards sources of income, it was noted that agriculture was the prime important source on both beneficiary as well as non beneficiary farms in both pre project and post project years. In the case of beneficiary farms the percentage of income from agriculture increased from 72.88 per cent in the pre project year to 73.69 per cent in the post project year. On the non beneficiary farms, the income in pre project year from agriculture was 73.03 per cent which decreased to 65.17 per cent in the post project year. Thus there was decrease in the proportion of income from agriculture on the non beneficiary farms from pre project year to post project year. The second important source of income on both beneficiary and non beneficiary farms was agricultural labour. The proportion of this source of income on beneficiary farms decreased from 9.60 per cent in the pre project year to 8.87 per cent in the post project year. On the other hand, the proportion of income from agricultural labour on non beneficiary farms increased from 10.25 per cent to 14.19 per cent.

This clearly shows that the agricultural sector on beneficiary farms gained strength due to watershed project whereas that on non beneficiary farms weakened. Similarly while dependence of beneficiary farms on agricultural labour declined, the same increased on non beneficiary farms (Table 4.15).

Table 4.15 Sourcewise income, beneficary and non beneficiary farms, Silyarinala watershed, Raipur district,Madhya Pradesh

(Value in Rs./ household)

Sources	Beneficiary			Non Beneficiary		
	Pre project	Post project	% change over pre project	Pre project	Post project	% change over pre project
Agriculture	13,569 (72.88)	29,187 (73.69)	115.10	13,309 (73.03)	21,114 (65.17)	58.64
Agril .labour	1,787 (9.60)	3,512 (8.87)	96.53	1,869 (10.25)	4,597 (14.19)	145.96
Non agril. labour	1,365 (7.33)	2,036 (5.14)	49.16	1,768 (9.70)	2,388 (7.37)	35.06
Livestock	169 (0.91)	814 (2.06)	381.66	--	--	--
Betel/Cycle/Kirana Shop	867 (4.66)	1,796 (4.53)	107.15	362 (1.99)	1,680 (5.18)	364.09
Blacksmithy/ Carpentry / Poultry	353 (1.90)	901 (2.27)	155.24	447 (2.46)	1,164 (3.59)	160.40
Others	507 (2.72)	1,363 (.3.44)	168.84	469 (2.57)	1,457 (4.50)	210.66
Total	**18,617 (100.00)**	**39,609 (100.00)**	**112.76**	**18,224 (100.00)**	**32,400 (100.00)**	**77.79**

4.1.12 Adoption of Improved Farming Practices

As the improved inputs are expensive farmers belonging to the rainfed areas are not inclined to adopt these inputs due to uncertainty in the crop output. The watershed development programme not only improves the availability of moisture and irrigation but also stops crop failures and gives stability to crop yields. Therefore, it is expected that the farming practices followed by the farmers belonging to the watershed area would be relatively improved than the farmers of non watershed area. In view of this, we tried to find out the extent of difference in the improved farming practices followed by the beneficiary and the non beneficiary sample farmers. We have presented here the adoption of improved farming practices for different crops followed by the sample farmers.

The adoption of improved farming practices was higher among the beneficiaries as compared to the non beneficiaries. The number of beneficiaries following the improved farming practices have also increased substaintially from the pre project year to the post project year. During the pre project year 40 per cent beneficiaries used improved seeds. This changed and 84.00 per cent beneficiaries used improved seeds in post project year. While 22.00 per cent of the non beneficiary farms used improved seed in the pre project year, 28.00 per cent used in post project year.

As regards seed treatment 20.00 per cent of beneficiary farms adopted the practice as against 8.00 per cent by non beneficiary farms in the pre project year. While the percentage of beneficiary farms adopting seed treatment increased to 44.00 in post project year that of non beneficiary farms increased to 18.00 per cent. With regard to fertilisers it was observed that 44.00 per cent of the beneficiary farms used these in pre project years. The percentage increased to 90.00 in post project year. On the other hand 35.00 per cent of the non beneficiary farms used fertilisers in the pre project year. The percentage increased to 68.00 in post project year (Table 4.16).

Table 4.16 Adoption of improved farming practices, beneficiary and non b eneficiary farms, Silyarinala watershed,Raipur district, Madhya Pradesh

(Figures-percentages)

Operation	Beneficiary		Non beneficiary	
	Pre project	Post project	Pre project	Post project
Seed	40.00	84.00	22.00	28.00
Seed treatment	20.00	44.00	8.00	18.00
Method of ploughing	20.00	30.00	6.00	18.00
Sowing implements	18.00	28.00	14.00	16.00
Manure use	58.00	88.00	48.00	62.00
Fertiliser use	44.00	90.00	35.00	68.00
Pesticide use	8.00	24.00	--	8.00
Threshing	40.00	80.00	35.00	65.00

4.1.13 Saplings Distribution

The important aspect of the saplings distribution was the survival percentage. It was observed that nearly 70.00 per cent of the guava samplings distributed survived but the survival percentage of mango and banana saplings was between 40.00 and 50.00. While the percentage of survival of lemon was 34.04 that of anwala was as high as 85.00. The survival rate was high for jamun (77.78 per cent) and bamboo (58.93 per cent) and was quite low in papita (28.57 per cent) and drum sticks (20.00 per cent). The survival percentage of all kinds of saplings taken together was less than 50.00 (46.56 per cent) (Table 4.17).

Table 4.17 Distribution of saplings, beneficiary farms, Siliyarinala watershed, Raipur district, Madhya Pradesh

Plant	Distributed (No.)	Survived (No.)	Percentage of survivals to number distributed
Guava	54	37	68.52
Mango	92	45	48.91
Banana	12	5	41.67
Lemon	47	16	34.04
Anwala	7	6	85.71
Karonda	12	4	33.33
Jackfruit	28	5	17.86
Cashewnut	4	--	--
Bamboo	56	33	58.93
Neem	2	1	50.00
Jamun	9	7	77.78
Papita	35	10	28.57
Ramphal	1	1	100.00
Drum stick	5	1	20.00
Neelgiri	4	--	--
Ber	2	--	--
Khamar	8	5	62.50
Total	**378**	**176**	**46.56**

4.1.14 Credit Facilities

Both beneficiary and non beneficiary farms were entitled to get credit from various institutions for agricultural and non agricultural purposes. Among beneficiary farms the percentage of loan taken from cooperative societies formed 87.11 per cent. This percentage for non beneficiary farms was 85.09. While Regional Rural Bank supplied 5.01 per cent of the loan to beneficiaries, it provided higher proportion (14.91 per cent) for

non beneficiaries. While Agriculture Department provided 7.88 per cent of the loan amount to beneficiaries non beneficiaries did not derive benefit from this source (Table4.18).

Table 4.18 Credit facilities, beneficiary and non beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

Purpose of loan	Sources of finance (Rs.)								
	Beneficiary					Non beneficiary			
	Cooperative society	Regional Rural Bank	Agril. Deptt.	Total	Percentage to total	Cooperative society	Regional Rural Bank	Total	Percentage to total
Fertiliser	1,22,995	--	--	1,22,995	42.14	11,785	--	11,785	27.07
Seed	23,500	--	--	23,500	8.05	4,225	--	4,225	9.69
Fertiliser + Cash	38,420	--	--	38,420	13.16	17,895	--	17,895	41.04
Fertiliser + Seed	52,500	--	--	52,500	17.99	--	--	--	--
Pesticides	16,800	--	--	16,800	5.76	3,200	--	3,200	7.34
Tube well	--	--	23,000	23,000	7.88	--	--	--	--
Bullocks + Cart	--	7,500	--	7,500	2.57	--	6,500	6,500	14.91
Sewing machine	--	1,125	--	1,125	0.39	--	--	--	--
Cycle repair	--	6,000	--	6,000	2.06	--	--	--	--
Total	**2,54,215**	**14,625**	**23,000**	**2,91,840**	**100.00**	**37,105**	**6,500**	**43,605**	**100.00**
Percentage to total	**87.11**	**5.01**	**7.88**	**100.00**		**85.09**	**14.91**	**100.00**	

4.1.15 Participation in Watershed Planning, Implementation and Training

Of the 50 beneficiary farmers 27 attended the meeting held before planning of crops. Following matters were discussed.

a) Improved varieties of seed and fertilisers.
b) Pesticides
c) Saplings of horticultural plants
d) Paddy seed treatment
e) Cattle development
f) Nallah bank stabilisation
g) Soybean cultural practices
h) Nadef preparation

Only 24 out of 50 beneficiaries participated in the training programmes conducted by the State Government. The programmes were concerning following matters.

a) Insecticides and pesticides
b) Recommended cultural practices of different crops
c) Fertilisers of different kinds
d) Saplings distribution
e) Nadef construction

As many as 22 out of 50 farmers knew the nominated Mitra Kisans of the villages. They had a chance to discuss following matters with him/her.

a) Improved seed
b) Nadef
c) Cultivation of gram
d) Fertilisers
e) Improved methods of cultivation
f) Cultivation of arhar on paddy bunds
g) Saplings available in nursery
h) Seed treatment and pesticides.

To the question whether the staff of NWDPRA visited his household or village 28 out of 50 replied in affirmative. They commended that the officials provided them useful information about agriculture and latest improved techniques.

Twenty one farmers did attend village meetings in which problems of water management were discussed. Farmers asked questions on various aspects and the officials gave suitable replies (Table 4.19).

Table 4.19 Participation in watershed planning, implementation and training, Raipur district, Madhya Pradesh

Question	Yes	No
Did you attended any meeting while planning for your watershed ?	27	23
Did you participate in any training programme conducted by the state government under NWDPRA ?	24	26
Do you know the nominated Mitra Kisan ?	22	28
Have the staff of NWDPRA visited you ?	28	22
Are there any village meetings in which the problem of watershed management was discussed ?	21	29

4.1.16 Assets Position

The assets on the selected farms comprised farm equipments and machinery, livestock and non farm assets. On beneficiary farms farm equipments and machinery constituted 40.15 per cent in the pre project year and 47.01 per cent in the post project year. The percentage of value of livestock, on the otherhand, decreased from 45.03 to 34.76. The non farm assets value increased in proportion from 14.82 to 18.23. It will thus be observed that while the percentage of value of farm assets and non farm assets increased from pre to post project year, the percentage of livestock value decreased. Similar trend was observed on the non beneficiary farms. In this category the percentage of value of farm assets increased from 46.46 to 51.57 and that of non farm assets from 9.99 to 12.57. The percentage of value of livestock declined from 43.55 to 35.86. Thus there was not much difference in the proportion of different kinds of assets both on beneficiary and non beneficiary farms (Table 4.20).

Table 4.20 Assets value position per household, beneficiary and non beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

(Value-Rs,/ household)

Name of the assets	Beneficiary			Non - Beneficiary		
	Pre project	Post project	% change over pre project	Pre project	Post project	% change over pre project
A. Farm assets						
Iron plough	144	166	15.28	53	58	9.43
Deshi plough	57	68	19.30	154	192	24.68
Harrow	21	37	76.19	23	31	34.78
Bullock cart	570	735	28.95	636	1,097	72.48
Buffaloe cart	197	249	26.40	228	372	63.16
Winower	42	54	28.57	31	38	22.58
Leveller	14	24	71.43	12	18	50.00
Tractor	3,680	6,969	89.38	3,020	4,816	59.47
Pump	315	1,366	333.65	297	1,194	302.02
Total farm assets	5,040 (40.15)	9,668 (47.01)	91.83	4,454 (46.46)	7,816 (51.57)	75.48
B. Non farm assets						
Cycle	889	1,362	53.21	228	373	63.60
Moped	170	287	68.82	243	392	61.32
Motorcycle	611	1,705	179.05	320	815	154.69
Transistor/Radio/TV	191	395	106.81	167	326	95.21
Total non farm assets	1,861 (14.82)	3,749 (18.23)	101.45	958 (9.99)	1,906 (12.57)	98.96
C. Livestock						
Cows	1,107	1,366	23.40	641	876	36.66
Bullocks	1,450	1,856	28.00	1,134	1,488	31.22
Buffaloes	712	934	31.18	874	1,053	20.48
He buffaloes	1,936	2,308	19.21	1,031	1,212	17.56
Calves	448	683	52.45	494	805	62.96
Total livestock	5,653 (45.03	7,147 (34.76)	26.43	4,174 (43.55)	5,434 (35.86)	30.19
Total value of assets	**12,554 (100.00)**	**20,564 (100.00)**	**63.80**	**9,586 (100.00)**	**15,156 (100.00)**	**58.11**

Figures in brackets are percentage to total

4.1.17 Employment Status

The total labour days per household increased from 358 to 369 on beneficiary farms. On the other hand the total labour days on non beneficiary farms slightly decreased from 404 days to 399 days. As seen in the previous table the percentage of value of assets in agricultural sector on beneficiary farms increased from pre project year to post project year. This was reflected in the employment scenario also. The labour days on own farms increased from 174 days to 217 days whereas hired labour days decreased from 184 days to 152 days. On the non beneficiary farms the employment position did not change much. The labour days on the own farm declined marginally from 209 days to 207 days (Table 4.21).

Table 4.21 Employment position of beneficiary and non beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

Particulars	Pre project			Post project		
	Male	Female	Total	Male	Female	Total
Beneficiary						
Hired out labour days	95	89	184 (51.40)	79	73	152 (41.19)
Used on own farm labour days	91	83	174 (48.60)	123	94	217 (58.81)
Total labour days	186	172	358	202	167	369 (100.00)
Non beneficiary						
Hired out labour days	104	91	195 (48.27)	98	94	192 (48.12)
Used on own farm labour days	112	97	209 (51.23)	105	102	207 (51.88)
Total labour days	216	188	404 (100.00)	203	196	399 (100.00)

Figures in brackets are percentages to total

4.1.18 Employment of Landless Labour Households

Among the selected beneficiary and non beneficiary households were a few landless labour households. The employment opportunity to these landless labour households was assessed for pre and post project years. It was observed that on the beneficiary farms the number of labour days per household increased from 254 days to 421 days, an increase of 65.75 per cent. On the non beneficiary farms the number of days increased from 237 days to 305 days or an increase of 28.69 per cent. In other terms the percentage of labour days on beneficiary farms was 7.17 more than non beneficiary farms in pre project year. In the post project year the increase was 38.03 per cent. The table clearly indicates that due to implementation of watershed development techniques not

only the employment of beneficiary farmers increased but also the employment opportunities of beneficiary landless labour increased. This was mainly due to change in cropping pattern, increase in irrigation and increase in intensity of cropping that the demand of landless labour increased especially on beneficiary households. A comparison of employment available for beneficiary landless households with that of non beneficiary landless labour households also goes to prove that employment of beneficiary landless labour household was highest than the non beneficiary landless labour households (Table 4.22).

Table 4.22 Availability of employment days for landless labour households, beneficiary and non beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

(Labour days / household/ year)

Period	Beneficiary farms			Non beneficiary farms			Increase in per cent over non beneficiary		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Pre project	161	93	254	103	134	237	56.31	(-) 30.67	7.17
Post project	254	167	421	147	158	305	72.79	5.70	38.03
Percentage of post project to pre project	57.76	79.57	65.75	42.72	17.91	28.69	--	--	--

4.1.19 Migration of Agricultural Labour

In the previous paragraph we have observed that on beneficiary farms the labour days per household increased from pre to post project year. It was also noted that the labour days on own farms increased and hired out labour days decreased. It goes to prove that employment opportunities increased due to watershed development. Conversely the tendency of migration to other place decreased. This will be seen from the table below which indicates that the number of migration days on beneficiary farms decreased from 180 days to 110 days or a decline of 38.89 per cent. On the non beneficiary farms the migration continued and to some extent increased in the post project year. The percentage increase was 14.29 (Table 4.23).

Table 4.23 Details of migration of landless labour households, beneficiary and non beneficiary farms, Silyarinala watershed, Raipur district, Madhya Pradesh

(Number of days / household/ year)

Period	Beneficiary	Non beneficiary
Pre project	180	105
Post project	110	120
Percentage change	61.11	114.29

4.1.20 Bio-mass Production

The bio-mass production is generally described in terms of grasses, legumes, fodder, fuel wood and horticultural / dryland horticultural development.

4.1.20.1 Grasses

In the non arable lands stone structures, checks across slopes, gully control and gabian structures were made. The objective of all these checks was to check the loss of soil cover and conserve run off water. Although these were undertaken in good number and gave results these were supposed to produce grasses around these due to conserved moisture. It was reported that grasses did come up around these but as there was no control on stray cattle on non arable lands these were easily grazed and did not benefit the village community.

4.1.20.2 Legumes

The selected beneficiary and non beneficiary farmers were traditionally accustomed to grow pulse crops as mixed crops with paddy. Of the various pulses, gram was the most profitable. The area under this crop increased in the post project year. However, the increase was only marginal and can not be said to have benefited either the selected farmers or the watershed area as such. Pulse crops other than gram had actually decreased area in the post project area.

4.1.20.3 Fodder

Chhattisgarh region is known as a rice bowl. Paddy is the main crop and dairying is yet not developed as a profession except around the big cities. There is not much need felt of improved fodder and the draught animals are fed on paddy straw. In the third chapter we have already observed that livestock management did not perform well. Further among livestock programmes, cultivated fodder production system programme did not receive any response of the farmers. This was when concerted efforts were made by livestock department. One can not expect the farmers to take up fodder development by themselves due to lack of dairy business. Although there was some improvement in by products supply of main crops due to higher yields, the fodder development programme as such was not successful.

4.1.20.4 Fuel wood

Although one of the objectives of conservation on non arable lands and waste lands was of planting fuel wood trees, not many efforts were made in this direction and little efforts made did not bear fruits. As a result fuel wood production was very insignificant.

4.1.20.5 Horticulture

We have earlier observed that on beneficiary farms the percentage increase in area under vegetables was 2.42. Under fruit crops fresh area was developed. Moreover, there was an increase in the percentage of irrigated area under both vegetables and fruits. On non beneficiary farms the percentage increase in area under vegetables was most marginal. Efforts were made by the watershed development authority to develop dry land horticulture by distributing saplings of fruits, bamboo, neem and neelgiris. The percentage of survival of the number of saplings was quiet good in some cases and poor in many cases. The overall impact of dry land horticulture was not worth noticing and mention due to lack of technical know how and lack of interest.

4.2 Present Status of Different Development Activities and Constraints

The targets and achievements of expenditure of Silyarinala watershed for different development activities envisaged in the project plan were already described in chapter III. The status of different development activities is summarised below :

4.2.1 Soil and Water Conservation

The activities such as contour bunds with vegetative hedges, earth/stone bunds, planting of dry land horticulture and agro-forestry trees, vegetative filter strips etc. were carried out on arable and non arable lands but these were found poor in shape and quality. Vegetative measures failed to grow on account of scanty rainfall and hence not established properly.

The quality of the structures created under watershed development programme was moderate or poor. Moreover, over a period of time, these structures got partly damaged. Due to non provision of repairs and maintenance the structures are not repaired. Hence, the damaged structures with poor quality failed to generate desired level of impact and benefits.

Vegetative bund programme has almost failed due to untimely rainfall and interest not shown by the farmers. Moreover, they preferred more water harvesting structures since the entire water in the catchment was drained fully through the gullied areas.

4.2.2 Production System

The second major component of watershed development plan is the promotion of diversified production system that can be sustained by the pattern of rainfall, available moisture and farmers' resources.

Mixed cropping and inter cropping have been followed under dry land technology along with horticulture development in arable lands. Of all the activities under production system dry land horticulture is the most important activity under Silyarinala watershed project.

4.2.2.1 Dry Land Horticulture

The objectives under dry land horticulture are to provide supplementary incomes to farmers, improve their nutrition and promote greenery of the project area. The saplings distributed among farmers included mango, guava, lemon, banana and jack fruit, etc. The survival of saplings of above species was estimated to be 60 per cent on beneficiary fields. All these species were suited to the local agro-climatic conditions. The saplings were obtained from the Mother Nursery developed by NWDPRA and this facilitated the growers not to go to far off places to fetch the saplings. The implementing agency developed a very good composite nursery and plants prepared in the nursery were of good quality. The programme was moderately successful.

4.2.2.2 Agro-Forestry

Agro-forestry included boundary planting of trees and alley cropping. This activity was given importance in watershed area mainly to increase supply of fuel and fodder as well as for providing roof cover and protection from hot winds for crops. The general impression gathered from the beneficiary farmers indicated very poor response.

4.2.2.3 Homestead Gardening

In order to improve the nutrition of rural population homestead gardens were encouraged. The beneficiary farmers showed moderate response. The main drawback was non availability of homesteads as majority of the farmers lived in limited space without any infrastructure suitable for homestead gardening.

4.2.2.4 Fodder Cultivation

The results under fodder cultivation programme were not encouraging. It can be said that fodder cultivation has not been practised on cultivators fields for improving animal nutrition in the watershed area.

4.2.3 Development and Diffusion of Dry Land Technology

4.2.3.1 Farmers Training

NWDPRA guidelines lay great emphasis on farmers' training. It is observed that the role played by Mitra Kisans and Gopals is limited in the new approach of watershed development and the officials also did not motivate the farmers to the desired extent. Some of the farmers were impressed by Kisan Melas and field visits and they practised the new methods of cultivation in sowing, balanced use of fertilisers and pesticides. People's involvement and mobilisation of local resources were very low. The attitude and participation of farmers in activities relating to common property resources was not statisfactory and they showed least interest in it.

4.2.3.2 Crop Demonstrations

Emphasis was laid on crop demonstrations. It is reported by the participant farmers that the progress of crop demonstration plots was not encouraging and many of them have not been implemented. Broadcasting is still in practice for many crops though line sowing is advocated. Inadequate supervision of demonstrations is also one of the problems expressed by the farmers in the watershed area.

4.2.4 Livestock Management

Animal husbandry programmes in the watershed area were rather weak. As per the norms, Gopals and self help groups were to be trained to conduct castration and artificial insemination methods. But this was not done in the watershed area during the project period.

We observe that the lack of effective coordination between project officials, agricultural extension department of the block and agricultural research station located near the block acted as a constraint.

In the project, the maximum permissible unit cost for different components has been fixed by considering labour and material cost at the time of formulation of the project. The labour and material cost has increased many-folds as compared to pre project, but financial ceiling fixed for project components remained the same. Hence, vegetative bunds and other structures created under the project were of inadequate size/ length and of poor quality. Hence, impact created by these structures was partial and limited.

4.3 CONCLUSIONS

1. Under preliminary activities a nursery and Chetna Kendra established at village Lawar, Silyarinala watershed, Raipur district had a significant impact.

2. Soil and water conservation activities are helpful in improving the irrigation potential, while contour bunding helped in reducing the velocity of run-off water and soil erosion.

3. Dug well irrigation/farm ponds leading to higher crop diversification and substitution of low value crops with more profitable crops due to watershed technology. At a few places around ponds vegetable cultivation was initiated and fishery was started.

4. Shift in cropping pattern is noticed in favour of remunerative crops. The project was helpful in increasing wage rate and gainful employment.

5. Additional areas are brought under cultivation after the treatment of watershed and thereby increased the crop intensity, crop production and also yields.

6. The works under non agricultural land development were insignificant in number and scattered to make any impact. Under planting of grasses, planting on nallah banks and afforestation very little was noticed to create an impact.

7. Other programmes, such as agro-forestry, pasture development and dairying should have been given enough attention.

4.4 SUGGESTIONS

With a view to remove constraints and to enhance overall effectiveness of NWDPRA programme, following suggestions are made for consideration.

1. Need for provision of funds for repairs and maintenance of damaged structures of the project. Improvement in the quality of structures will help in generating positive impact.

2. Need for revising all financial ceiling and cost norms for different components of the project at intervals of time in the context of changes in labour rates and material cost.

3. The watershed Department Team (WDT) at block level must work out an arrangement with the nearest nationalised/ cooperative/ rural banks for providing financial support to project beneficiaries for purchasing required inputs in adequate quantity as an when needed.

4. Implementing agency is strictly following the financial allocations indicated for project components. This gives rise to a situation wherein there is a shortage of funds for one activity and a surplus of funds for some other activity. Therefore, it is essential to allow inter component flexibility of funds at watershed level in the process of implementation. Conditions in all the watersheds vary in respect of soil quality, soil slope, drainage lines and infrastructure. Hence, requirement of funds for the same component varies from one watershed to another depending upon the local conditions. Therefore, block level WDT may be allowed to alter the inter-component allocation of funds.

5. Efforts are needed to strengthen the coordination between implementing agency, WDT, departments of agriculture, horticulture, forestry, veterinary and fishery, leading and progressive farmers and scientists of the watershed area. Efforts are also needed to increase the peoples' participation in the activities related with common property resources. The entire programme needs awakening among villagers for their participation. Without the active participation of people the programme would achieve only limited success.

6. In order to fully utilise the allocated funds and to harness the maximum potential benefits from the watershed development programme, it is essential to bring all the watershed development activities under a single control at the watershed level and to improve the quality of planning and implementation, Universities and Research Institutes may also be allowed to involve along with the watershed development agency right from the planning stage of the watershed development programme.

7. Arrangement for external monitoring and evaluation of the project at regular intervals is must. This will help the implementing agency to effect midcourse corrections for enhancing the impact of the project.

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CHAPTER V

SUMMARY AND CONCLUSIONS

5.1 Watershed is a geo-hydrological unit or a piece of land that drains at a common point. It comprises of arable land, non arable land and natural drainage lines in rainfed areas.

The watershed management focuses on conservation, use and improvement of land, water and other resources on a sustainable basis. It aims at slowing down or even reversing the run off and sedimentation of water resources. The watershed development project was an integrated project involving close coordination of departments of agriculture, horticulture, forestry, veterinary and fishery.

The sectors of watershed development were : arable or cultivated land, non arable land and natural drainage lines. For a household the sub components would be food, fodder, fuel and household production system.

Agro-economic Research Centre, Jabalpur already undertook the study titled "Impact of National Watershed Development Project for Rainfed Areas (NWDPRA) - A study in Raipur and Khargone districts of Madhya Pradesh" in 1995. The Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India desired that the impact of NWDPRA be reassessed in Raipur district of Madhya Pradesh.

The objectives of the study are:

(i) To examine the change in cropping pattern, crop sequencing and crop components under the production systems in arable lands.

(ii) To examine the change in overall biomass production in the forms of grasses, legumes, fodder, fuel wood, horti-plantation canopies in treated watershed against the control.

(iii) To examine the addition (numerically) of various forms of water bodies / water harvesting structures viz sunken dugouts, dug wells, recharge wells, farm ponds, run-off management structures etc. and the long term impact on water table in the dug wells / recharge wells.

(iv) To identify the improvement in socio-economic / income status of project beneficiaries against non-beneficiaries.

(v) To identify the status of migration of people, especially landless labourers and cattle from watershed to outside areas.

(vi) To suggest strategies for removal of the constraints faced in NWDPRA.

In the selected Raipur district, one watershed i.e. "Silyarinala " was selected and fifty beneficiaries and twenty five non-beneficiaries were selected earlier in 1995. The present study intends to collect data for same number of beneficiaries (50) and non-beneficiaries (25) from Silyarinala watershed of Raipur district. Beneficiaries were those whose farms and villages were located in the selected watershed area. Non beneficiaries were those whose farms and villages were located outside the watershed area.

The analysis pertained to the data for the year 1999-2000 for selected beneficiaries and non-beneficiaries. The secondary data was collected for the period 1990-91 to 1997-98.

5.2 Raipur district was situated in the south eastern part of the state. The area of the district was 21,274 sq.km. River Mahanadi flowed through the district from south west to north east. The climate was, in general, warm and humid. The district received an average rainfall of 1,385 mm. While the southern and south eastern part of the district received copious rains the western tract which included selected watershed suffered from scarcity of rainfall.

The average size of holdings was 1.522 hectares. Marginal size holdings predominated. Of the total geographical area 62.73 per cent was net area sown. The district had only 10.47 per cent area under forest. Paddy occupied 76.24 per cent of the cropped area. Lathyrus occupied 15.38 per cent. Of the gross cropped area 38.10 per cent was irrigated. Paddy was irrigated to the extent 47.57 per cent and wheat, 48.97 per cent. The main sources of irrigation were government canals which commanded as high as 81.36 per cent of the irrigated cropped area. Tanks commanded 5.82 per cent, tubewells, 5.47 per cent and wells, 4.06 per cent.

5.3 Silyarinala watershed of Raipur district was situated at a distance of 60 km. north of simga. It came under Mahanadi basin. The watershed had 8 villages and the slope was from south to north. Silyarinala joined the Sheonath river.

The annual rainfall of the watershed was more than 1,000 mm. It was highest in 1994-95 (1,605.10 mm.) and lowest (876.90 mm.) in 1998-98. The groundwater availability was poor and there was no water logging problem. The total population of the watershed increased from 9,211 in 1990-91 to 12,607 in 1996-97 or an increase of 36.87 per cent.

The total geographical area of the Silyarinala watershed was 3,151.633 hectares. The effective project area in both the reference years was 3,066.000 hectares.

The watershed had 1,138 land holdings. Of these 40.68 per cent were marginal and covered 15.69 per cent of the area. Another 34.45 per cent were small and covered 26.27 per cent of the area. Thus the overall size of holdings was quite small.

In Silyarinala watershed Matasi soil constituted 35.00 per cent. Matasi could not grow a second crop Kanhar constituted 30.00 per cent. It was a black clay which was very retentive of moisture. It was, however, capable of growing a second crop and from that point of view, was certainly the most valuable soil in the watershed area. Dorsa formed 25.00 per cent and was a mixture of Kanhar and Matasi. It was a good soil for paddy but gave only a moderate outturn of wheat or second crop. The Bhata which formed 10.00 per cent was a poor detritus of laterite, red in colour and containing numerous little pebbles. It did not have much consistency and hardly retained any moisture.

In 1996-97 paddy formed largest percentage of 77.21. Other important crops were gram (6.75 per cent) and til (5.81 per cent). In 1990-91 also paddy was the most important crop constituting 86.73 per cent. Gram was second important crop with 3.35 per cent of the area.

The single cropped area, double cropped area and area under irrigation increased from 1990-91 to 1996-97.

In 1990-91, the productivity (yield per hectare) of paddy was slightly lower than 1996-97. The yield per hectare of soybean was higher by 58.68 per cent. The yields of urad, arhar, til, wheat and gram also showed an increase in 1996-97 over 1990-91.

The number of tractors increased from 7 in 1990-91 to 13 in 1996-97. The number of diesel pumps increased from 4 to 10 and that of electric pumps from 5 to 22 during the same years. The number of dusters increased from 6 to 14 and the number of sprayers increased from to 10 to 52 and the cultivators increased from 7 to 13.

The livestock population in 1996-97 increased by 45.32 per cent. The milk and fish production increased in 1996-97.

The total expenditure includes expenditure incurred from 1990-91 till 1997-98. The financial target for the entire period was Rs. 68.737 lakhs. The main thrust was on development of arable lands and shared 33.39 per cent of the total target amount. The next important item of target was basic activities and shared 32.79 per cent of the target amount. The third important item was the development of non-arable lands and had 14.85 per cent of the targeted amount for it. Drainage line treatment had 10.79 per cent of the total targeted amount and the livestock management had a share of 8.18 per cent of the targeted amount. Against the target amount of Rs. 68.737 lakhs the achievement was Rs. 59.343 lakhs. Thus the target fell short by 13.67 per cent. In the cases of conservation measures on non arable lands, drainage line treatment in the upper reaches, middle reaches and lower reaches, development of arable lands, conservation measures and production system the achievement was nearly 100.00 per cent. The achievement for non arable lands and production systems was low.

For basic activities the achievement was nearly 100.00 per cent.

Under arable lands development activity the achievement was nearly 100.00 per cent.

In the non arable land development activities in the non arable land development activities the achievement was nearly total except water harvesting tanks were achievement percentage was 33.57.

In the soil and water conservation measures the drainage line is treated at upper reaches, middle reaches and lower reaches. In all these measures the achievement was nearly cent per cent.

In livestock management activity the achievement was 82.81 per cent.

5.4 Of the 50 beneficiaries 32.00 per cent were those who received saplings of various trees. Eighteen per cent beneficiaries received saplings along with irrigation pipes. Another 10.00 per cent received poultry birds. Eight per cent each received saplings along with weedicides and help in Nadef construction plus demonstrations and saplings, poultry birds, irrigation pipes plus grain bins.

The operated area of 50 beneficiaries was 160.73 hectares or 3.21 hectares per beneficiary. The operated area per non beneficiary was 1.66 hectares or half of the beneficiary farms. The gross cropped area of the beneficiary farms was 189.30 hectares. This means that the cropping intensity was 117.77 per cent .On the non beneficiary farms the cropping intensity was 107.10 per cent.

The irrigation intensity on beneficiary farms was 131.52 per cent. On the non beneficiary farms the irrigation intensity was 134.17 per cent. On both beneficiary and non beneficiary farms wells/tube wells were the main sources of irrigation. While the contribution of wells / tube wells on beneficiary farms was 59.29 per cent that on non beneficiary farms was 55.91 per cent .Farm ponds were sources of irrigation only on beneficiary farms as these qualified the beneficiary farms to be so being the main activity of the watershed. Percentage of area commanded by tanks and nallahs was higher on non beneficiary farms.

The number of families having wells / tubewells increased from 10 to 19 in the post project period among the beneficiaries and the same increased from 2 to 3 among the non beneficiaries. This shows that percentage increase in number of farm wells is much higher for watershed region. The beneficiary households, though a few in number (8), prepared sunken farm ponds to store the run off rain water.

Nearly 30 per cent beneficiary households reported that due to watershed treatment, the water table of the wells / tubewells increased by 0.31 to 0.92 metre in the average monsoon year. Nearly 20 per cent reported marginal increase in water table of the wells / tubewells.

In the case of beneficiary farms although paddy was the most important crop, its proportion in the gross cropped area got reduced by about 6.00 per cent in the post project year against the pre project year. On the other hand the post project year's cropping pattern showed increase over pre project cropping pattern in the cases of crops like wheat, gram, soybean, vegetables and fruits. Thus the proportion of area in the post project year increased in commercial crops. Another feature was percentage increase in the area under improved varieties of paddy in the post project year. In the case of non beneficiary farms although the percentage of area under paddy increased by about 2.00 per cent in the post project year, the proportion under improved paddy was more than double than that of pre project year.

The irrigated crops were maize, groundnut, soybean, wheat, gram, vegetables and fruits. In the case of maize, groundnut, soybean, vegetables and fruits the entire cropped area was irrigated in the post project year. Wheat was irrigated to the extent of 94.00 per cent. Gram was irrigated to the extent of 67.42 per cent and paddy, 45.84 per cent.

In the case of non beneficiary farms wheat and vegetables were fully irrigated in both pre project and post project years.

A change in crop sequence was noticed from pre project to post project year. While there was not much variation in the cultivation of single crop of paddy or kodo-kutki variation was noticed in crop sequence of paddy- teora so that teora was replaced by vegetables. In the cropping sequence with soybean crop the change was such that in rabi season apart from wheat and gram, vegetables were grown. Another change was that instead of usual food grains, fruits were grown.

Mixed cropping and inter cropping are practised by the farmers of rainfed area to guard against failure of crops in the case of water stress or insect or pest attacks. With the development of watershed the water is partly assured and therefore a farmer can take the risk of taking a sole crop. Our observations showed that in the case of beneficiary farms the percentage of farmers practising sole cropping increased from 44.00 to 68.00 in the post project year. The percentage of farmers among non beneficiaries was 26.00 and 38.00 respectively.

It was observed that the number of crops grown by beneficiary farmers was more than the non beneficiary farmers. Maize, urad, moong, groundnut, til and linseed were not

at all grown by non beneficiary farmers. It was also noted that there was an increase from pre project yield to post project yield in most of the crops.

The five important crops on the selected farms were paddy, wheat, gram, teora and soybean. The profitability of these crops has been compared for beneficiary and non beneficiary farms. The profit per hectare for all the five crops was higher in the post project year than the pre project year.

The profitability for improved varieties of paddy on beneficiary farms was slightly higher than non beneficiary farms. Similarly profitability on beneficiary farms was higher than non beneficiary farms for wheat, gram and soybean.

The total income per household of beneficiary farms in the pre project year was Rs.18,617.00. It increased to Rs.39,609.00 in the post project year indicating more than double increase in income. In the case of non beneficiary farms the income per household increased from Rs.18,224.00 to Rs.32,400.00 or an increase of 77.79 per cent.

The agricultural sector on beneficiary farms gained strength due to watershed project whereas that on non beneficiary farms weakened. Similarly while dependence of beneficiary farms on agricultural labour declined, the same increased on non beneficiary farms.

The watershed development programme not only improves the availability of moisture and irrigation but also stops crop failures and gives stability to crop yields.

The adoption of improved farming practices was higher among the beneficiaries as compared to the non beneficiaries. The number of beneficiaries following the improved farming practices have also increased substaintially from the pre project year to the post project year.

Of the 50 beneficiary farmers 27 attended the meeting held before planning of crops.

Only 24 out of 50 beneficiaries participated in the training programmes conducted by the State Government.

As many as 22 out of 50 farmers knew the nominated Mitra Kisans of the villages.

To the question whether the staff of NWDPRA visited his household or village 28 out of 50 replied in affirmative. They commended that the officials provided them useful information about agriculture and latest improved techniques.

While the percentage of value of farm assets and non farm assets increased from pre to post project year, the percentage of livestock value decreased. Similar trend was observed on the non beneficiary farms.

The total labour days per household increased from 358 to 369 on beneficiary farms. On the other hand the total labour days on non beneficiary farms slightly decreased from 404 days to 399 days. The labour days on own farms increased from 174 days to 217 days whereas hired labour days decreased from 184 days to 152 days. The labour days on the own farm declined marginally from 209 days to 207 days.

It was observed that on the beneficiary farms the number of labour days of landless labour households per household increased from 254 days to 421 days an increase of 65.75 per cent. On the non beneficiary farms the number of days increased from 237 days to 305 days or an increase of 28.69 per cent. The data clearly indicates that due to implementation of watershed development techniques not only the employment of beneficiary farmers increased but also the employment opportunities of beneficiary landless labour increased. This was mainly due to change in cropping pattern, increase in irrigation and increase in intensity of cropping that the demand of landless labour increased especially on beneficiary households.

In the previous paragraph we have observed that on beneficiary farms the labour days per household increased from pre to post project year. It was also noted that the labour days on own farms increased and hired out labour days decreased. It goes to prove that employment opportunities increased due to watershed development. Conversely the tendency of migration to other place decreased.

The bio-mass production is generally described in terms of grasses, legumes, fodder, fuel wood and horticultural / dryland horticultural development.

In the non arable lands stone structures, checks across slopes, gully control and gabian structures were made. The objective of all these checks was to check the loss of soil cover and conserve run off water. Although these were undertaken in good number and gave results these were supposed to produce grasses around these due to conserved moisture. It was reported that grasses did come up around these but as there was no control on stray cattle on non arable lands these were easily grazed and did not benefit the village community.

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3. The watershed Department Team (WDT) at block level must work out an arrangement with the nearest nationalised/ cooperative/ rural banks for providing financial support to project beneficiaries for purchasing required inputs in adequate quantity as an when needed.

4. Implementing agency is strictly following the financial allocations indicated for project components. This gives rise to a situation wherein there is a shortage of funds for one activity and a surplus of funds for some other activity. Therefore, it is essential to allow inter component flexibility of funds at watershed level in the process of implementation. Conditions in all the watersheds vary in respect of soil quality, soil slope, drainage lines and infrastructure. Hence, requirement of funds for the same component varies from one watershed to another depending upon the local conditions. Therefore, block level WDT may be allowed to alter the inter-component allocation of funds.

5. Efforts are needed to strengthen the coordination between implementing agency, WDT, departments of agriculture, horticulture, forestry, veterinary and fishery, leading and progressive farmers and scientists of the watershed area. Efforts are also needed to increase the peoples' participation in the activities related with common property resources. The entire programme needs awakening among villagers for their participation. Without the active participation of people the programme would achieve only limited success.

6. In order to fully utilise the allocated funds and to harness the maximum potential benefits from the watershed development programme, it is essential to bring all the watershed development activities under a single control at the watershed level and to improve the quality of planning and implementation, Universities and Research Institutes may also be allowed to involve along with the watershed development agency right from the planning stage of the watershed development programme.

7. Arrangement for external monitoring and evaluation of the project at regular intervals is must. This will help the implementing agency to effect midcourse corrections for enhancing the impact of the project.

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ANNEXURE –I

Comments received from the Agro-Economic Research Centre, Allahabad

1.	**Title of the draft report No.82 examined**	:	Impact Evaluation of NWDPRA in Madhya Pradesh
2.	**Date of receipt of draft report**	:	29.5.2001
3.	**Date of despatch of comments**	:	08.10.2001

4. **Details of comments on the methodology adopted in the study**

a) The selection procedure of the district is not clarified. It should be mentioned clearly that why Raipur district has been selected.

b) Also the selection procedure of watershed i.e. Silyarinala is not mentioned. The sampling design must be detailed to give a clear picture of the samples. The number of villages as well as the categories of sample beneficiaries non-beneficiaries must be clarified and be given in tabular form in the final report.

c) The chapter scheme must a1so be given in the methodology itself.

d) The method of data collection both primary and secondary has not been mentioned in the methodology. The schedules and questionnaires are also not given anywhere either in the methodology or in the appendix.

5. Comments on the adequacy and coverage of the objectives of the study

a) In the objective No.1 the changes in the land utilization pattern has been left. It must be added in the final report.

b) Objective No.vi is not required hence it must be dropped in the final report.

c) The five objectives are to the point and adequate to cover all the aspects of this study.

6. <u>Comments on presentation and get up of the draft report</u>

<u>Chapter – I</u>

i) Nothing is mentioned about the real problem of the study i.e. bout silyarinala micro-water-shed of Raipur district. It must be detailed in the final report.

ii) This chapter also lacks the details and continuity about the required information regarding state, district and micro-watershed studied.

Chapter -II

i) This chapter is not required. Therefore, it must be dropped in the final report.

ii) Thus, the profile of Silyarinala micro-watershed given in Chapter III must be given in Chapter II now.

iii) Accordingly chapter IV i.e. Impacts of selected watershed will be chapter III now and chapter IV which has been left in this draft report i.e. constraints in the implementation of NWDPRA programme and suggestions for improvement must be included as chapter IV in the final report.

Chapter -III

i) This chapter will be chapter II in the final report now and its name i.e. title must be written as 'Profile of Silyarinala Watershed'.

ii) Also the changes after the implementation of NWDPRA programme in Silyarinala watershed in Arable and Non-Arable lands found by soil-conservation unit must be included in this chapter.

iii) Also the reference year i.e. VIII Five Year Plan (1990-91 to 1996-97) must be the same in cases of all the information given.

Chapter – IV

i) This chapter will be chapter III in the final report now and its title will be as 'Impact of NWDPRA Programme in Silyarinal Watershed' instead of impact of selected watershed as written in draft report.

ii) Also, instead of giving distribution of different characteristics of the beneficiaries and non-beneficiaries, only the impact assessment on the required aspects must be analysed in the form of before and after the implementation of NWDPRA in this micro-watershed.

iii) The categories of beneficiaries as well as non-beneficiaries must also be given and the analysis must be done accordingly in the final report.

Chapter – V

i) Before this chapter, in chapter IV i.e. on Constraints and Suggestions for improvement must be included in the final report.

ii) In this chapter only the summary of main findings in the suitable headings must be given in the final report. There is no need of summarising the whole report unnecessarily.

iii) The suggestions must be based on the main findings of this study and must be given in chapter IV alongwith the constraints in the implementation of programme and suggestions for improvement.

7. The Executive Summary must be changed according to the changes suggested to be included in the final report.

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ANNEXURE – II

Action taken by the author based on the comments of the draft report titled Impact of NWDPRA in Madhya Pradesh

1. Title of the draft report No.82 examined : No comments

2. Date of receipt of draft report : No comments

3. Date of despatch of comments : No comments

4. Details of comments on the methodology adopted in the study

a) The selection procedure is clarified under paragraph 1.6.

b) The selection procedure of the watershed and the selection procedure of beneficiaries and non beneficiaries and the details of villages selected also have been noted under paragraph 1.6 and tables 1.1 and 1.2.

c) The chapter scheme is given in the table of contents.

d) The details of data collection both primary and secondary have been given in paragraph 1.8.

5. Comments on the adequacy and coverage of the objectives of the study

a) The objective no. (i) does not include change in land utilisation pattern.

b) The objective no. (vi) is dropped.

c) No comments.

6. Comments on presentation and get up of the draft report

Chapter – I

i) A full chapter III has been devoted to describe the Silyarinala Watershed.

ii) The report contains a chapter each on Raipur district (Chapter-II) and Profile of Silyarinala watershed (Chapter III).

Chapter – II

i) The comment that chapter II is not required and should be dropped is confusing as in comment (ii) under chapter-I, it has been mentioned that the chapter lacks continuity about the required information regarding state, district and micro watershed studied. We think that the background information of selected (Raipur) district is essential and therefore chapter II has been retained.

ii) As above. Therefore Profile of Silyarinala Watershed would have a separate chapter III.

iii) As given under (i) above. In view of this Impact of Silyarinala Watershed would continue to be chapter IV. It is surprising to note that we are advised to drop objective no.(vi) on one hand (see para (b) of comment on the adequacy and coverage of the objectives of the study) and on the other hand we are asked to write chapter IV on constraints in the implementation of the NWDPRA. It may be noted that the constraints in the watershed development have been noted under paragraph 4.2 - Present Status of Different Development Activities although no separate chapter has been drafted for this.

Chapter – III

i) As per explanation given to comment (i) of chapter II above, title of the chapter III has been changed to "Profile of Silyarinala Watershed".

ii) This has been included under the chapter IV- Impact of Silyarinala Watershed.

iii) The reference year for the secondary data was VIII Five Year Plan. However when the field investigation was done additional secondary data was made available by the officials. Wherever this was available this has been given.

Chapter – IV

i) As explained on the comments (i) of chapter II. The title of the chapter has been changed to "Impact of NWDPRA Programme in Silyarinala Watershed".

ii) It is helpful to describe the characteristics of the beneficiaries and non beneficiaries before the impact assessment and therefore the characteristics part has been retained.

iii) The overall impact of the NWDPRA programme on beneficiaries and non beneficiaries has been studied. The groupwise impact was neither necessary nor expected to be given as per the objectives of the study.

Chapter V

(i) Constraints have been given under paragraph 4.2 and suggestions for improvement have been given under paragraph 4.4.

(ii) The summary of the report is usually given for different chapters and this has been done. Moreover, conclusions and suggestions are also given in this chapter.

(iii) The suggestions are based on the main findings of investigation, discussion with the concerned officials and also our own observations.

7. No comments.

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EXECUTIVE SUMMARY

IMPACT EVALUATION OF NWDPRA IN MADHYA PRADESH

1. Introduction

Watershed is a geo-hydrological unit or a piece of land that drains at a common point. It comprises of arable land, non arable land and natural drainage lines in rainfed areas.

The watershed management focuses on conservation, use and improvement of land, water and other resources on a sustainable basis. It aims at slowing down or even reversing the run off and sedimentation of water resources. The watershed development project was an integrated project involving close coordination of departments of agriculture, horticulture, forestry, veterinary and fishery.

The sectors of watershed development were : arable or cultivated land, non arable land and natural drainage lines. For a household the sub components would be food, fodder, fuel and household production system.

Agro-economic Research Centre, Jabalpur already undertook the study titled "Impact of National Watershed Development Project for Rainfed Areas (NWDPRA) - A study in Raipur and Khargone districts of Madhya Pradesh" in 1995. The Directorate of Economics & Statistics, Ministry of Agriculture, Govt. of India desired that the impact of NWDPRA be reassessed in Raipur district of Madhya Pradesh.

2. Objectives of the Study

The objectives of the study are:

(i) To examine the change in cropping pattern, crop sequencing and crop components under the production systems in arable lands.

(ii) To examine the change in overall biomass production in the forms of grasses, legumes, fodder, fuel wood, horti-plantation canopies in treated watershed against the control.

(iii) To examine the addition (numerically) of various forms of water bodies / water harvesting structures viz sunken dugouts, dug wells, recharge wells, farm ponds, run-off management structures etc. and the long term impact on water table in the dug wells / recharge wells.

(iv) To identify the improvement in socio-economic / income status of project beneficiaries against non-beneficiaries.

(v) To identify the status of migration of people, especially landless labourers and cattle from watershed to outside areas.

(vi) To suggest strategies for removal of the constraints faced in NWDPRA.

3. Methodology

In the selected Raipur district, one watershed i.e. "Silyarinala " was selected and fifty beneficiaries and twenty five non-beneficiaries were selected earlier in 1995. The present study intends to collect data for same number of beneficiaries (50) and non-beneficiaries (25) from Silyarinala watershed of Raipur district. Beneficiaries were those whose farms and villages were located in the selected watershed area. Non beneficiaries were those whose farms and villages were located outside the watershed area.

The analysis pertained to the data for the year 1999-2000 for selected beneficiaries and non-beneficiaries. The secondary data was collected for the period 1990-91 to 1997-98.

4. Raipur District

Raipur district was situated in the south eastern part of the state. The area of the district was 21,274 sq.km. River Mahanadi flowed through the district from south west to north east. The climate was, in general, warm and humid. The district received an average rainfall of 1,385 mm. While the southern and south eastern part of the district received copious rains the western tract which included selected watershed suffered from scarcity of rainfall.

The average size of holdings was 1.522 hectares. Marginal size holdings predominated. Of the total geographical area 62.73 per cent was net area sown. The district had only 10.47 per cent area under forest. Paddy occupied 76.24 per cent of the cropped area. Lathyrus occupied 15.38 per cent. Of the gross cropped area 38.10 per cent was irrigated. Paddy was irrigated to the extent 47.57 per cent and wheat, 48.97 per cent. The main sources of irrigation were government canals which commanded as high as 81.36 per cent of the irrigated cropped area. Tanks commanded 5.82 per cent, tubewells, 5.47 per cent and wells, 4.06 per cent.

5. Silyarinala Watershed

Silyarinala watershed of Raipur district was situated at a distance of 60 km. north of simga. It came under Mahanadi basin. The watershed had 8 villages and the slope was from south to north. Silyarinala joined the Sheonath river.

The annual rainfall of the watershed was more than 1,000 mm. It was highest in 1994-95 (1,605.10 mm.) and lowest (876.90 mm.) in 1998-98. The groundwater availability was poor and there was no water logging problem. The total population of the watershed increased from 9,211 in 1990-91 to 12,607 in 1996-97 or an increase of 36.87 per cent.

The total geographical area of the Silyarinala watershed was 3,151.633 hectares. The effective project area in both the reference years was 3,066.000 hectares.

The watershed had 1,138 land holdings. Of these 40.68 per cent were marginal and covered 15.69 per cent of the area. Another 34.45 per cent were small and covered 26.27 per cent of the area. Thus the overall size of holdings was quite small.

In Silyarinala watershed Matasi soil constituted 35.00 per cent. Matasi could not grow a second crop Kanhar constituted 30.00 per cent. It was a black clay which was very retentive of moisture. It was, however, capable of growing a second crop and from that point of view, was certainly the most valuable soil in the watershed area. Dorsa formed 25.00 per cent and was a mixture of Kanhar and Matasi. It was a good soil for paddy but gave only a moderate outturn of wheat or second crop. The Bhata which formed 10.00 per cent was a poor detritus of laterite, red in colour and containing numerous little pebbles. It did not have much consistency and hardly retained any moisture.

In 1996-97 paddy formed largest percentage of 77.21. Other important crops were gram (6.75 per cent) and til (5.81 per cent). In 1990-91 also paddy was the most important crop constituting 86.73 per cent. Gram was second important crop with 3.35 per cent of the area.

The single cropped area, double cropped area and area under irrigation increased from 1990-91 to 1996-97.

In 1990-91, the productivity (yield per hectare) of paddy was slightly lower than 1996-97. The yield per hectare of soybean was higher by 58.68 per cent. The yields of urad, arhar, til, wheat and gram also showed an increase in 1996-97 over 1990-91.

The number of tractors increased from 7 in 1990-91 to 13 in 1996-97. The number of diesel pumps increased from 4 to 10 and that of electric pumps from 5 to 22 during the same years. The number of dusters increased from 6 to 14 and the number of sprayers increased from to 10 to 52 and the cultivators increased from 7 to 13.

The livestock population in 1996-97 increased by 45.32 per cent. The milk and fish production increased in 1996-97.

6. Financial Targets and Achievements of Expenditure

The total expenditure includes expenditure incurred from 1990-91 till 1997-98. The financial target for the entire period was Rs. 68.737 lakhs. The main thrust was on development of arable lands and shared 33.39 per cent of the total target amount. The next important item of target was basic activities and shared 32.79 per cent of the target amount. The third important item was the development of non-arable lands and had 14.85 per cent of the targeted amount for it. Drainage line treatment had 10.79 per cent of the total targeted amount and the livestock management had a share of 8.18 per cent of the targeted amount. Against the target amount of Rs. 68.737 lakhs the achievement was Rs. 59.343 lakhs. Thus the target fell short by 13.67 per cent. In the cases of conservation measures on non arable lands, drainage line treatment in the upper reaches, middle reaches and lower reaches, development of arable lands, conservation measures and production system the achievement was nearly 100.00 per cent. The achievement for non arable lands and production systems was low.

For basic activities the achievement was nearly 100.00 per cent.

Under arable lands development activity the achievement was nearly 100.00 per cent.

In the non arable land development activities in the non arable land development activities the achievement was nearly total except water harvesting tanks were achievement percentage was 33.57.

In the soil and water conservation measures the drainage line is treated at upper reaches, middle reaches and lower reaches. In all these measures the achievement was nearly cent per cent.

In livestock management activity the achievement was 82.81 per cent.

7. Characteristics of and Impact on Selected Beneficiaries

Of the 50 beneficiaries 32.00 per cent were those who received saplings of various trees. Eighteen per cent beneficiaries received saplings along with irrigation pipes. Another 10.00 per cent received poultry birds. Eight per cent each received saplings along with weedicides and help in Nadef construction plus demonstrations and saplings, poultry birds, irrigation pipes plus grain bins.

The operated area of 50 beneficiaries was 160.73 hectares or 3.21 hectares per beneficiary. The operated area per non beneficiary was 1.66 hectares or half of the beneficiary farms. The gross cropped area of the beneficiary farms was 189.30 hectares. This means that the cropping intensity was 117.77 per cent .On the non beneficiary farms the cropping intensity was 107.10 per cent.

The irrigation intensity on beneficiary farms was 131.52 per cent. On the non beneficiary farms the irrigation intensity was 134.17 per cent. On both beneficiary and non beneficiary farms wells/tube wells were the main sources of irrigation. While the contribution of wells / tube wells on beneficiary farms was 59.29 per cent that on non beneficiary farms was 55.91 per cent .Farm ponds were sources of irrigation only on beneficiary farms as these qualified the beneficiary farms to be so being the main activity of the watershed. Percentage of area commanded by tanks and nallahs was higher on non beneficiary farms.

The number of families having wells / tubewells increased from 10 to 19 in the post project period among the beneficiaries and the same increased from 2 to 3 among the non beneficiaries. This shows that percentage increase in number of farm wells is much higher for watershed region. The beneficiary households, though a few in number (8), prepared sunken farm ponds to store the run off rain water.

Nearly 30 per cent beneficiary households reported that due to watershed treatment, the water table of the wells / tubewells increased by 0.31 to 0.92 metre in the average monsoon year. Nearly 20 per cent reported marginal increase in water table of the wells / tubewells.

In the case of beneficiary farms although paddy was the most important crop, its proportion in the gross cropped area got reduced by about 6.00 per cent in the post project year against the pre project year. On the other hand the post project year's cropping pattern showed increase over pre project cropping pattern in the cases of crops like wheat, gram, soybean, vegetables and fruits. Thus the proportion of area in the post project year increased in commercial crops. Another feature was percentage increase in the area under improved varieties of paddy in the post project year. In the case of non beneficiary farms

although the percentage of area under paddy increased by about 2.00 per cent in the post project year, the proportion under improved paddy was more than double than that of pre project year.

The irrigated crops were maize, groundnut, soybean, wheat, gram, vegetables and fruits. In the case of maize, groundnut, soybean, vegetables and fruits the entire cropped area was irrigated in the post project year. Wheat was irrigated to the extent of 94.00 per cent. Gram was irrigated to the extent of 67.42 per cent and paddy, 45.84 per cent.

In the case of non beneficiary farms wheat and vegetables were fully irrigated in both pre project and post project years.

A change in crop sequence was noticed from pre project to post project year. While there was not much variation in the cultivation of single crop of paddy or kodo-kutki variation was noticed in crop sequence of paddy- teora so that teora was replaced by vegetables. In the cropping sequence with soybean crop the change was such that in rabi season apart from wheat and gram, vegetables were grown. Another change was that instead of usual food grains, fruits were grown.

Mixed cropping and inter cropping are practised by the farmers of rainfed area to guard against failure of crops in the case of water stress or insect or pest attacks. With the development of watershed the water is partly assured and therefore a farmer can take the risk of taking a sole crop. Our observations showed that in the case of beneficiary farms the percentage of farmers practising sole cropping increased from 44.00 to 68.00 in the post project year. The percentage of farmers among non beneficiaries was 26.00 and 38.00 respectively.

It was observed that the number of crops grown by beneficiary farmers was more than the non beneficiary farmers. Maize, urad, moong, groundnut, til and linseed were not at all grown by non beneficiary farmers. It was also noted that there was an increase from pre project yield to post project yield in most of the crops.

The five important crops on the selected farms were paddy, wheat, gram, teora and soybean. The profitability of these crops has been compared for beneficiary and non beneficiary farms. The profit per hectare for all the five crops was higher in the post project year than the pre project year.

The profitability for improved varieties of paddy on beneficiary farms was slightly higher than non beneficiary farms. Similarly profitability on beneficiary farms was higher than non beneficiary farms for wheat, gram and soybean.

The total income per household of beneficiary farms in the pre project year was Rs.18,617.00. It increased to Rs.39,609.00 in the post project year indicating more than

double increase in income. In the case of non beneficiary farms the income per household increased from Rs.18,224.00 to Rs.32,400.00 or an increase of 77.79 per cent.

The agricultural sector on beneficiary farms gained strength due to watershed project whereas that on non beneficiary farms weakened. Similarly while dependence of beneficiary farms on agricultural labour declined, the same increased on non beneficiary farms.

The watershed development programme not only improves the availability of moisture and irrigation but also stops crop failures and gives stability to crop yields.

The adoption of improved farming practices was higher among the beneficiaries as compared to the non beneficiaries. The number of beneficiaries following the improved farming practices have also increased substaintially from the pre project year to the post project year.

Of the 50 beneficiary farmers 27 attended the meeting held before planning of crops.

Only 24 out of 50 beneficiaries participated in the training programmes conducted by the State Government.

As many as 22 out of 50 farmers knew the nominated Mitra Kisans of the villages.

To the question whether the staff of NWDPRA visited his household or village 28 out of 50 replied in affirmative. They commended that the officials provided them useful information about agriculture and latest improved techniques.

While the percentage of value of farm assets and non farm assets increased from pre to post project year, the percentage of livestock value decreased. Similar trend was observed on the non beneficiary farms.

The total labour days per household increased from 358 to 369 on beneficiary farms. On the other hand the total labour days on non beneficiary farms slightly decreased from 404 days to 399 days. The labour days on own farms increased from 174 days to 217 days whereas hired labour days decreased from 184 days to 152 days. The labour days on the own farm declined marginally from 209 days to 207 days.

It was observed that on the beneficiary farms the number of labour days of landless labour households per household increased from 254 days to 421 days an increase of 65.75 per cent. On the non beneficiary farms the number of days increased from 237 days to 305 days or an increase of 28.69 per cent. The data clearly indicates that due to

implementation of watershed development techniques not only the employment of beneficiary farmers increased but also the employment opportunities of beneficiary landless labour increased. This was mainly due to change in cropping pattern, increase in irrigation and increase in intensity of cropping that the demand of landless labour increased especially on beneficiary households.

In the previous paragraph we have observed that on beneficiary farms the labour days per household increased from pre to post project year. It was also noted that the labour days on own farms increased and hired out labour days decreased. It goes to prove that employment opportunities increased due to watershed development. Conversely the tendency of migration to other place decreased.

The bio-mass production is generally described in terms of grasses, legumes, fodder, fuel wood and horticultural / dryland horticultural development.

In the non arable lands stone structures, checks across slopes, gully control and gabian structures were made. The objective of all these checks was to check the loss of soil cover and conserve run off water. Although these were undertaken in good number and gave results these were supposed to produce grasses around these due to conserved moisture. It was reported that grasses did come up around these but as there was no control on stray cattle on non arable lands these were easily grazed and did not benefit the village community.

The selected beneficiary and non beneficiary farmers were traditionally accustomed to grow pulse crops as mixed crops with paddy. Of the various pulses, gram was the most profitable. The area under this crop increased in the post project year. However, the increase was only marginal and can not be said to have benefited either the selected farmers or the watershed area as such.

Chhattisgarh region is known as a rice bowl. Paddy is the main crop and dairying is yet not developed as a profession except around the big cities. There is not much need felt of improved fodder and the draught animals are fed on paddy straw. Among livestock programmes, cultivated fodder production system programme did not receive any response of the farmers. This was when concerted efforts were made by livestock department. One can not expect the farmers to take up fodder development by themselves due to lack of dairy business. Although there was some improvement in by products supply of main crops due to higher yields, the fodder development programme as such was not successful.

Although one of the objectives of conservation on non arable lands and waste lands was of planting fuel wood trees, not many efforts were made in this direction and little efforts made did not bear fruits. As a result fuel wood production was very insignificant.

On beneficiary farms the percentage increase in area under vegetables was 2.42. Under fruit crops fresh area was developed. Moreover, there was an increase in the percentage of irrigated area under both vegetables and fruits. Efforts were made by the watershed development authority to develop dry land horticulture by distributing saplings of fruits, bamboo, neem and neelgiris. The percentage of survival of the number of saplings was quite good in some cases and poor in many cases. The overall impact of dry land horticulture was not worth noticing and mention due to lack of technical know how and lack of interest.

8. Present Status of Different Development Activities

The activities such as contour bunds with vegetative hedges, earth/stone bunds, planting of dry land horticulture and agro-forestry trees, vegetative filter strips etc. were carried out on arable and non arable lands but these were found poor in shape and quality. Vegetative measures failed to grow on account of scanty rainfall and hence not established properly.

The quality of the structures created under watershed development programme was moderate or poor. Moreover, over a period of time, these structures got partly damaged. Due to non provision of repairs and maintenance the structures are not repaired. Hence, the damaged structures with poor quality failed to generate desired level of impact and benefits.

Vegetative bund programme has almost failed due to untimely rainfall and interest not shown by the farmers. Moreover, they preferred more water harvesting structures since the entire water in the catchment was drained fully through the gullied areas.

The objectives under dry land horticulture are to provide supplementary incomes to farmers, improve their nutrition and promote greenery of the project area. The saplings distributed among farmers included mango, guava, lemon, banana and jack fruit, etc. The survival of saplings of above species was estimated to be 60 per cent on beneficiary fields. The programme was moderately successful.

Agro-forestry included boundary planting of trees and alley cropping. This activity was given importance in watershed area mainly to increase supply of fuel and fodder as well as for providing roof cover and protection from hot winds for crops. The general impression gathered from the beneficiary farmers indicated very poor response.

In order to improve the nutrition of rural population homestead gardens were encouraged. The beneficiary farmers showed moderate response. The main drawback was non availability of homesteads as majority of the farmers lived in limited space without any infrastructure suitable for homestead gardening.

The results under fodder cultivation programme were not encouraging. It can be said that fodder cultivation has not been practised on cultivators fields for improving animal nutrition in the watershed area.

NWDPRA guidelines lay great emphasis on farmers' training. It is observed that the role played by Mitra Kisans and Gopals is limited. Some of the farmers were impressed by Kisan Melas and field visits and they practised the new methods of cultivation in sowing, balanced use of fertilisers and pesticides. People's involvement and mobilisation of local resources were very low.

Emphasis was laid on crop demonstrations. It is reported by the participant farmers that the progress of crop demonstration plots was not encouraging and many of them have not been implemented. Broadcasting is still in practice for many crops though line sowing is advocated. Inadequate supervision of demonstrations is also one of the problems expressed by the farmers in the watershed area.

Animal husbandry programmes in the watershed area were rather weak. As per the norms, Gopals and self help groups were to be trained to conduct castration and artificial insemination methods. But this was not done in the watershed area during the project period.

We observe that the lack of effective coordination between project officials, agricultural extension department of the block and agricultural research station located near the block acted as a constraint.

The vegetative bunds and other structures created under the project were of inadequate size/ length and of poor quality. Hence, impact created by these structures was partial and limited.

9. Conclusions

1. Under preliminary activities a nursery and Chetna Kendra established at village Lawar, Silyarinala watershed, Raipur district had a significant impact.

2. Soil and water conservation activities are helpful in improving the irrigation potential, while contour bunding helped in reducing the velocity of run-off water and soil erosion.

3. Dug well irrigation/farm ponds leading to higher crop diversification and substitution of low value crops with more profitable crops due to watershed technology. At a few places around ponds vegetable cultivation was initiated and fishery was started.

4. Shift in cropping pattern is noticed in favour of remunerative crops. The project was helpful in increasing wage rate and gainful employment.

5. Additional areas are brought under cultivation after the treatment of watershed and thereby increased the crop intensity, crop production and also yields.

6. The works under non agricultural land development were insignificant in number and scattered to make any impact. Under planting of grasses, planting on nallah banks and afforestation very little was noticed to create an impact.

7. Other programmes, such as agro-forestry, pasture development and dairying should have been given enough attention.

10. Suggestions and Policy Implications

With a view to remove constraints and to enhance overall effectiveness of NWDPRA programme, following suggestions are made for consideration.

1. Need for provision of funds for repairs and maintenance of damaged structures of the project. Improvement in the quality of structures will help in generating positive impact.
   Attention : Ministry of Agriculture, Govt. of India

2. Need for revising all financial ceiling and cost norms for different components of the project at intervals of time in the context of changes in labour rates and material cost.
   Attention : Ministry of Agriculture, Govt. of India

3. The watershed Department Team (WDT) at block level must work out an arrangement with the nearest nationalised/ cooperative/ rural banks for providing financial support to project beneficiaries for purchasing required inputs in adequate quantity as an when needed.
   Attention : Directorate of Agriculture, Govt. of Madhya Pradesh

4. Implementing agency is strictly following the financial allocations indicated for project components. This gives rise to a situation wherein there is a shortage of funds for one activity and a surplus of funds for some other activity. Therefore, it is essential to allow inter component flexibility of funds at watershed level in the process of implementation. Conditions in all the watersheds vary in respect of soil quality, soil slope, drainage lines and infrastructure. Hence, requirement of funds for the same component varies

from one watershed to another depending upon the local conditions. Therefore, block level WDT may be allowed to alter the inter-component allocation of funds.

Attention : Ministry of Agriculture, Govt. of India and Directorate of Agriculture, Govt. of Madhya Pradesh

5. Efforts are needed to strengthen the coordination between implementing agency, WDT, departments of agriculture, horticulture, forestry, veterinary and fishery, leading and progressive farmers and scientists of the watershed area. Efforts are also needed to increase the peoples' participation in the activities related with common property resources. The entire programme needs awakening among villagers for their participation. Without the active participation of people the programme would achieve only limited success.
   Attention : Govt. of Madhya Pradesh

6. In order to fully utilise the allocated funds and to harness the maximum potential benefits from the watershed development programme, it is essential to bring all the watershed development activities under a single control at the watershed level and to improve the quality of planning and implementation, Universities and Research Institutes may also be allowed to involve along with the watershed development agency right from the planning stage of the watershed development programme.
   Attention : Govt. of Madhya Pradesh and Agricultural University of Madhya Pradesh

7. Arrangement for external monitoring and evaluation of the project at regular intervals is must. This will help the implementing agency to effect midcourse corrections for enhancing the impact of the project.
   Attention : Govt. of Madhya Pradesh

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