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Research Paper :

Performance evaluation of soil and water conservation structures in Darakwadi watershed

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ABSTRACT

Darakwadi watershed was developed by 'Dilasa Janvikas Pratishthan', Aurangabad (Maharashtra). In this various soil and water conservation structures; continuous contour trenches(CCT), earthen gully plugs(EGP), earthen nala bunds (ENB), composite cement nala bund(CCNB), gabion cum wall (GCW), cement check dam(CCD) and percolation tank (PT) were constructed. The present study was under taken to know the impact of soil and water conservation structures on crop production and rural community in the watershed. Silt deposition in the CCT, EGP, ENB, permanent structures (CCNB, GCW and CCD) and percolation tank was found to be 619.87 tones, 32.76 tones, 1291.96 tones, 1356.4 tones and 1307.53 tones, respectively. An average reduction in storage capacity of EGP, ENB, permanent structures (CCNB, GCW, CCD) and percolation tank was found to be 3.55%, 7.76%, 7.62% and .02%, respectively. Increase in area under cultivation, pasture and forest was found to be 6.19% and 1.49 %, respectively. Increase in area under cultivation during *Kharif, Rabi* and summer season was found to be 7.96 %, 7.43 % and 2.48 %, respectively during post development period.

Key words : Soil conservation, Water conservation, Evaluation

Land and water are the most precious heritage and physical base of biomass production. Major source of water for dry land agriculture is the rainfall received from south west monsoon during the period from June to September, which is erratic in nature, unevenly distributed and sometimes it is inadequate to meet the soil moisture requirement of crops. Watershed development is the only way to make efficient and judicious use of rain water (Gore *et al.*, 2000; Rathod and Ingole, 2002).

The Darakwadi watershed has been developed by 'Dilasa Janvikas Pratishthan', Aurangabad (Maharashtra) in the year 2002-03. Major activities under taken in this watershed were continuous contour trenches (CCT), earthen gully plugs (EGP), earthen nala bunds (ENB), composite cement nala bund, gabion cum wall (GCW), cement check dam (CCD) and percolation tank (PT). So far efficient water management is concerned, it performance is needed to be evaluated.

METHODOLOGY

Measurement of silt deposition:

The data on silt deposition *i.e.* depth of silt deposited in the storage area, were collected. For this, small pits were made in impounding area of the structure up to a depth of original ground surface at different locations and an average depth of silt was deposited was determined.

The area of silt deposited was measured by dividing it into regular triangles and rectangles. Volume of silt deposited was measured by multiplying the area of silt deposition and depth of deposited. Weight of silt deposited was calculated by multiplying the volume of silt by bulk density of silt. The bulk density of silt was found to be 1.25 gm/cc.

Socio-economic study:

The socio-economic study was carried out in the Darakwadi watershed to asses the impact of the watershed development programme on village peoples and farming system. The data pertaining to the socio–economic conditions of the farmers by personnel interview method on various aspects such as land use pattern, cropping pattern etc. these data were compared with predevelopment data.

RESULTS AND DISCUSSION

Silt deposition in various soil and water conservation structures have been discussed in the following points.

Continuous contour trenches (CCT):

The data on silt deposition are tabulated in Table 1, which reveals that total 619.87 tones of silt has been arrested in the trenches over the period of two years after the construction of continuous contour trenches.

Table 1: Silt deposition in continuous contour trenches (CCT)

CCT No.	Average depth of silt deposition(m)	Area of silt deposition (m^2)	Volume of silt deposition(m^3)	Weight of silt deposition (tones)
1	0.12	381.25	45.75	57.18
2	0.15	432.17	64.82	81.03
3	0.13	373.49	48.55	60.68
4	0.17	294.29	56.02	62.53
5	0.14	361.28	50.57	63.22
6	0.13	329.90	42.88	53.60
7	0.14	409.16	57.28	71.60
8	0.15	323.37	48.50	60.63
9	0.12	359.31	43.11	53.89
10	0.13	341.61	44.40	55.51
Total silt deposition in continuous contour trenches =				619.87

Earthen gully plug (EGP):

Table 2, reveals that an average annual soil loss of earthen gully plug was found to be 0.312, 0.306, 0.305, 0.324, 0.273 and 0.348 tones/ha/hr, respectively. Which was in permissible limit of soil erosion? Total silt deposited in six earthen gully plug (EGP) was found to be 32.76 tones during the period of two years after the construction of structures.

Earthen nala bund (ENB):

Table 3 reveals that, total silt deposited in impounding area was found to be 1291.96 tones. Per cent reduction in storage capacity of all the six earthen nala bund was found to be 8.07, 10.38, 5.92, 10.30, 6.82 and 5.08, respectively over the period of two years after construction.

Permanent structures:

Table 4 reveals that total silt deposited at all the structures was found to be 1356.4 tones during the period of two years from the catchment's area of composite cement nala bund(CCNB), gabion cum wall (GCW),

Table 2 : Silt deposition in earthen gully plug (EGP)

EGP No.	Catchment area (ha)	Storage capacity (m^3)	Average depth of silt deposition (m)	Area of silt deposition (m^2)	Volume of silt deposition (m^3)	Wt. of silt deposition (tones)	Erosion rate (t/ha/yr)	Current storage capacity(m^3)	Reduction in storage area (%)
1	5	75.26	0.19	13.20	2.50	3.12	0.312	72.76	3.32
2	9	112.07	0.24	18.38	4.41	5.51	0.306	107.66	3.93
3	7	91.58	0.23	14.87	3.42	4.27	0.305	88.16	3.73
4	11	171.23	0.29	19.72	5.71	7.13	0.324	165.52	3.33
5	8	96.45	0.23	15.26	3.50	4.37	0.273	92.95	3.62
6	12	198.42	0.25	20.91	6.69	8.36	0.348	191.73	3.37
Total silt deposition in earthen gully plug						32.76			3.55

Table 3 : Silt deposition in earthen nala bund (ENB)

EGP No.	Catchment area (ha)	Storage capacity (m^3)	Average depth of silt deposition (m)	Area of silt deposition (m^2)	Volume of silt deposition (m^3)	Wt. of silt deposition (tones)	Erosion rate (t/ha/yr)	Current storage capacity(m^3)	Reduction in storage area (%)
1	34.60	1144.06	0.24	385.19	92.44	115.55	1.66	1051.62	8.07
2	69.29	1497.60	0.27	576.07	155.53	194.41	1.40	1342.07	10.38
3	70.58	2850.81	0.25	675.54	168.11	211.10	1.49	2681.291	5.92
4	75.17	1950.37	0.23	873.67	200.94	251.18	1.67	1749.43	10.30
5	84.77	2898.41	0.24	824.17	197.80	247.25	1.45	2700.61	6.82
6	91.09	4284.72	0.26	838.39	217.98	272.47	1.49	4066.74	5.08
Total silt deposition in earthen nala bund						1291.96			7.76

Table 4: Silt deposition in permanent structures (CCNB, GCW, CCD-1, CCD - 2)

Strures	Catchment area (ha)	Storage capacity (m^3)	Average depth of silt deposition (m)	Area of silt deposition (m^2)	Volume of silt deposition (m^3)	Wt. of silt deposition (tones)	Erosion rate (t/ha/yr)	Current storage capacity(m^3)	Reduction in storage area (%)
CCNB	103.55	3970.21	0.40	763.24	305.29	381.62	1.84	3664.92	7.68
GCW	129.20	540.79	0.27	228.03	61.56	76.95	0.297	479.23	11.38
CCD-1	97.03	4607.50	0.34	817.11	277.81	347.27	1.78	4329.69	6.02
CCD-2	454.21	8098.75	0.41	1074.27	440.45	550.56	0.606	7658.30	5.43
Total silt deposition in permanent structures						1356.4			7.62

cement check dam 1(CCD) and cement check dam 2(CCD). The average annual soil loss was found to be 1.84, 0.297, 1.78 and 0.606 tones/ha/yr, respectively which was in permissible limit. The storage capacity of these storage structures was reduced by 7.68%, 11.38%, 6.02% and 5.43%, respectively as compared to the design storage capacity.

Percolation tank:

From Table 5 it can be said that, total silt deposited in impounding area of percolation tank was found to be 1307.53 tones. An average annual soil loss from the catchment area was found to be 1.83 tones/ha/yr. The storage capacity of the tank was reduced by 0.20% over the period of two years.

Socio-economic impact of soil and water conservation structures:

The data regarding the land use pattern and cropping pattern are given in Table 6. Land use pattern over that area, under cultivation, pasture and forest was increased from 77.78 to 83.97, 7.97 to 9.46 per cent, respectively.

Table 5: Silt deposition in percolation tank

Structure	Catchment area (ha)	Storage capacity (m^3)	Average depth of silt deposition (m)	Area of silt deposition (m^2)	Volume of silt deposition (m^3)	Wt. of silt deposition (tones)	Erosion rate (t/ha/yr)	Current storage capacity (m^3)	Reduction in storage area (%)
P.T.	238.05	522000.36	0.43	2432.63	1046.03	1307.53	1.83	520954	0.20

Table 6: Land use pattern in Darakwadi watershed

Sr. No.	Land use	Pre-development (2002-03)		Post-development (2003-04)	
1.	Area under cultivation	372.59	77.78	402.24	83.97
2.	Area under pasture and forest	38.18	7.97	45.28	9.46
3.	Area under fallow land	68.23	14.25	--	--
4.	Area under construction like ENB, CNB, Road etc.	--	--	31.48	6.57
		479	100.00	479	100.00

Table 7: Cropping pattern in Darakwadi watershed

Sr. No.	Crop	Pre-development: area (ha)			Post-development: area (ha)			Per cent increase or decrease in area		
		Kharif	*Rabi*	Summer	*Kharif*	*Rabi*	Summer	*Kharif*	*Rabi*	Zaid
1.	Cereals	132.61	141.58	--	114.23	122.00	--	-13.86	-13.92	--
2.	Pulses	45.12	18.25	--	52.05	23.80	--	15.35	30.40	--
3.	Oil seeds	39.08	19.87	--	44.10	22.24	60.000	12.84	11.92	60.00
4.	Cotton	106.17	106.17	--	110.20	110.20	--	3.79.	11.92	--
5.	Vegetables	28.38	36.29	20.36	35.28	42.00	48.00	24.31	15.73	135.75
6.	Fodder	11.20	15.24	28.72	18.38	25.00	70.00	64.10	64.04	143.73
7.	Mulberry	2.00	2.00	2.00	10.00	10.00	10.00	400.00	64.04	143.73
8.	Citrus	8.00	8.00	8.00	18.00	18.00	18.00	125.00	64.04	143.73
	Total	372.56	347.4	59.08	402.24	373.84	206.00	7.96	7.43	248.67
			372.59			402.24				

Also it was seen that in post development period area under fallow land was brought under cultivation.

Also, considering the cropping pattern, area under cultivation during *Kharif, Rabi* and Zaid season was found to be 7.96%, 7.43% and 248.67%, respectively during the post development period.

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