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Research Paper :

Evaluation of soil conservation structure in Shamwadi watershed

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ABSTRACT

Shamwadi watershed is located in Aurangabad district of Maharashtra. This watershed was developed by 'Dilasa Janvikas Pratishthan', Aurangabad. In silt deposition study, the data on the depth of silt deposited were collected. Small pits were made in impounding area of structure up to a depth of original ground surface at different location and average depth of silt deposited was measured. Area of silt deposited in regular triangles and rectangles. Volume of silt deposited at each structure was estimated by multiplying the area of silt deposition and depth of silt deposited. Weight of silt deposited was calculated by multiplying the volume of silt and bulk density of silt. The bulk density of silt is 1.3 g/cc. The total silt deposited in all 12 lines of continuous contour trenches was found to be 599.765 tonnes. Total silt deposited in all 12 loose boulders structures was found to be 30.99 tonnes, over the period of 6 years after the construction. Silt deposited in all the cement nala bunds was found to be 1190.01 tonnes, over the period of three years after their construction. The total silt deposited in all five earthen nala bunds was found to be 1880.90 tonnes over the period of 6 years after their construction.

Key words : Soil conversation structure, Watershed

Soil and water are the basic resources essential for the survival of human kind. In India out of total geographical area 326.8mha, about 81 million hectare land is affected by erosion, in other terms, Out of net cultivated area of 185.8mha, 56.7mha land is suffering from erosion, either due to water or wind. out of these (56.7mha) 40mha, land is severely affected and needed immediate control measures. On an average soil due to erosion in the country is 16.4tonnes per hectare per year (Mittal *et al*.,1986).

Watershed management is a single window integrated participatory and sustainable area development programme of a geophysical defined natural drainage unit of land. Soil and water conservation is a very important aspect of watershed management but in order to realize the highest benefits for the people, the other aspect like socio-economic situation should not be neglected. Watershed management indicates the wise use of natural resources within given geographical area so as to enable sustainable production with minimum hazards.

Therefore, watershed management is a holistic approach arrived at optimizing the use of land, water and vegetation in an area and thus providing solution to alleviate drought, moderate floods, prevent soil erosion, improve water availability and increase fuel, fodder and agriculture production on sustained basis. A watershed is the total land area above a given point on a water way that contributes a runoff to the flow at that point. In planning watershed development programme various types of soil and water conservation works such as bunding, terracing, nala bunding, underground diaphragms, diversion ditches, vegetative waterways are taken according to the availability of site, location and land capability classification.

The conservation structures are an integral part of soil and water conservation programmes and important component of the watershed development and management programme. Conservation structures not only control the erosion and conserve water but also help in meeting the socio-economic demand in various ways. It is therefore, important to plan the watershed on sound technical knowledge to save the land from erosion and degradation, to conserve water and improve soil for maximum production in the interest of the nation as well as individual farmer.

METHODOLOGY

Shamwadi village is a part of Bakapur Gram Panchayat, located in Aurangabad District of Marathwada region 15km away from Aurangabad city.

Watershed development programme was implemented by Dilasa Janvikas Pratisthan, (NGO) Aurangabad and District Rural Development Agency (DRDA) under Drought Prone Area Programme (DPAP) a scheme of Central Government. Shamwadi watershed covered the area comprising of three hamlets of different communities with 800 population. The geographical area

of Shamwadi watershed was 1161.54ha.Shamwadi watershed comprised of sub watersheds *viz*., Shamwadi-I and Shamwadi-II. Shamwadi Watershed is situated at an altitude 560 m above mean sea level.

Area and topography:

Topography of watershed was undulating with semi arid area. The general slope of cultivable land in the watershed ranged from 3 to 4.5 per cent, where as slope of non-cultivable land ranged from 14 to 32 per cent. The soil of watershed could be classified into textural classes namely sandy clay, clay soil, and loam soil. The pH of the soil of watershed ranged between 7.5 to 8.5. Land capability classes and soil characteristics of Shamwadi Watershed are presented in Table 1.

Table 1 : Land capability classification and soil texture of Shamwadi Watershed

Sr. No.	Particular	Area(ha)
1.	**Land capability classes**	
	Class-II	320.07
	Class-III	384.50
	Class-IV	119.80
	Class-V	1037.72
	Total	1862.09
2.	**Soil texture**	
	Sandy clay soil	475.47
	Sandy loam soil	245.47
	Loam soil	148.00
	Clay loam	68.24
	Sandy	60.17
	Total	997.35

Climate:

The watershed area falls within the tropical semi arid zone of central Maharashtra. Average annual rainfall is 760 mm of which 80% is received from south-west monsoon which extended from mid June to mid September.

Vegetation:

The vegetation in the area before implementation of watershed devlopement programme was not thick, some local trees like Custard-apple, Neem and Karwands were found spread over the watershed area.

Cropping pattern:

The cropping pattern and cropping system is mainly influenced by rainfall pattern. The cropping pattern followed before the development of watershed during *Kharif* and *Rabi* season is as follows:

***Kharif*:** Maize, Bajara, Peagon-pea, Hybrid Sunflower.

***Rabi*:** Wheat, Jowar, Sunflower, Gram

Soil and water conservation treatments detail:

The various soil and water conservation structures adopted in Shamwadi watershed are listed in Table 2.

Table 2 : Soil and water conservation structures in Shamwadi Watershed

Sr. No.	Name of structure	No. of structures construted/area in ha.	No. of structure under study
1.	Grassed farm contour bunding.	126ha	---
2.	Afforestation on bunding	95ha	---
3.	Continuous contour trenching	32.20ha	8ha
4.	Loose boulder structure	82 Nos	12Nos
5.	Earthen nala bunds	5Nos	5Nos
6.	Cement nala bunds	3Nos	3Nos

Measurement of silt deposition:

The data on the depth of silt deposited were collected. Small pits were made in impounding area of structure up to a depth of original ground surface at different location and average depth of silt deposited was measured. Area of silt deposited in regular triangles and rectangles. Volume of silt deposited at each structure was estimated by multiplying the area of silt deposition and depth of silt deposited. Weight of silt deposited was calculated by multiplying the volume of silt and bulk density of silt. The bulk density of silt is 1.3 g/cc.

RESULTS AND DISCUSSION

The results obtained from the present investigation are summarized below :

Silt deposition at continuous contour trenches:

The data on volume and weight of silt deposited at continuous contour trenches are presented in Table 3. From the Table 3 it can be seen that average depth of silt deposited at continuous contour trenches ranged between 0.210 to 0.235 m and area of silt deposition at continuous contour trenches ranged between 218.75 to 372.00 m^2. Total 599.756 tonnes silt has been deposited over the period

Table 3 : Silt deposition at continuous contour trenches

CCT. line No.	Year of construction	Average depth of silt deposition (m)	Area of silt deposited (m^2)	Volume of silt deposited (m^3)	Weight of silt deposition(tones)
1	1997	0.230	218.75	50.31	38.70
2	1997	0.225	221.40	49.81	38.31
3	1997	0.225	229.90	51.72	39.79
4	1997	0.228	238.81	54.45	41.88
5	1997	0.225	359.91	56.23	43.25
6	1997	0.230	276.75	63.65	48.96
7	1997	0.220	292.125	64.26	49.43
8	1997	0.210	317.50	66.67	51.28
9	1997	0.220	333.36	73.34	56.41
10	1997	0.225	352.00	79.20	60.92
11	1997	0.230	359.375	82.65	63.58
12	1997	0.235	372.000	87.42	67.24
Total silt deposition at CCT					599.75

of seven years after their construction in the continuous contour trenches, which otherwise would have carry below to the reservoir or elsewhere deposited. Thus the erosion rate on this land worked out to be 10.70 tonnes/ ha/year. The continuous contour trenches had capacity to intercept the flowing water *i.e.* after 7 years of their construction.

Silt deposition at loose boulder structure:

The data on silt deposited at different loose boulder structures are presented in Table 4. From the above Table 4 it can be seen that average depth of silt deposited at different loose boulder structures ranged from 0.18-0.25 m and area of silt deposition ranged between 12.08 to 20.30 m^2 where as weight of silt deposited at different loose boulder structures ranged from 1.68 to 3.36 tonnes. Total silt deposited at all 12 loose boulder structures was found to be 30.98 tonnes during the last six years after the construction.

Silt deposition at earthen nala bunds:

The data on silt deposition at earthen nala bund is shown in the Table 5. From the Table 5 it can be seen that average depth of silt deposited at different nala bunds ranged between 0.49 to 0.69 m. and area of silt deposited in all five earthen nala bunds was found to be 1880.90 tonnes during the period of four year after their construction.

The average annual soil loss from the catchment area of ENB A, B, C, D and E was found to be 1.358,

Table 4 : Silt deposition at loose boulder structure

LBS No.	Year of construction	Average depth of silt deposition (m)	Area of silt deposited (m^2)	Volume of silt deposited (m^3)	Weight of silt deposition(tones)
1	1998	0.18	12.20	2.196	1.68
2	1998	0.21	16.30	3.423	2.63
3	1998	0.19	18.87	3.585	2.75
4	1998	0.23	15.03	3.456	2.65
5	1998	0.22	14.80	3.256	2.5
6	1998	0.25	16.05	4.010	3.08
7	1998	0.23	12.08	2.770	2.13
8	1998	0.24	18.20	4.368	3.36
9	1998	0.18	19.18	3.452	2.65
10	1998	0.20	20.30	4.060	3.12
11	1998	0.23	12.18	2.800	2.15
12	1998	0.22	13.48	2.965	2.28
Total silt deposition at LBS.					30.98

Table 5 : Silt deposition at earthen nala bund

ENB	Year of construction	Catchment area (ha)	Designed storage capacity (m^3)	Average depth of silt deposition(m)	Area of silt deposition (m^2)	Volume of silt deposition (m^3)	Weight of silt deposition (tonnes)	Present storage capacity (m^3)	Percent reduction in storage capacity (%)
A	2000	81.50	5008	0.62	928.70	575.7	442.90	4432.30	11.49
B	2000	82.10	4253	0.49	1021.21	500.3	384.90	3852.70	8.989
C	2000	81.24	5218	0.65	903.50	587.2	451.70	4530.80	11.47
D	2000	80.57	4780	0.69	651.92	449.8	346.00	4330.20	9.41
E	2000	84.99	4200	0.58	572.51	332.0	255.40	3668.00	7.9
						Total	1880.9		

Table 6 : Silt deposition at cement nala bunds

CNB	Year of construction	Catchment area (ha)	Designed storage capacity (m^3)	Average depth of silt deposition (m)	Area of silt deposition (m^2)	Volume of silt deposition (m^3)	Weight of silt deposition (tonnes)	Present storage capacity (m^3)	Percent reduction in storage capacity (%)
1	2001	156.44	3825	0.72	878.87	632.64	486.64	3192.36	16.53
2	2001	239.55	4540	0.65	721.42	468.92	360.71	4071.08	10.32
3	2001	296.98	5200	0.58	768.03	445.45	342.65	4754.55	8.50
			Total				1190		

1.172, 1.39, 1.07 and 0.75 tonnes/ha/year. The per cent storage capacity of these earthen nala bunds reduced in the range of 7.9 to 11.49 per cent.

Silt deposition at cement nala bund:

The data on silt deposition at cement nala bund are presented in Table 6. From the Table 6 it can be seen that average depth of silt deposited at different cement nala bunds 1, 2 and 3 were 0.72, 0.65 and 0.58 m, respectively. Area of silt deposited at cement nala bunds, 1, 2 and 3 were 878.67, 721.42 and 768.03 m^2, respectively. The total silt deposited at all three CNB was found to be 1190 tonnes during the three years after their construction.

Average annual soil loss from the catchment area of cement nala bunds 1, 2, and 3 was found to be 1.036, 0.501 and 0.384 tonnes/ha/year, which was within permissible limit because of soil conservation practices adopted in the catchment area of CNB. Storage capacity of these cement nala bunds reduced as 16.53, 10.32 and 8.50%, respectively over the period of three years after their construction.

Conclusion:

In silt deposition study, total silt deposition in all 12 lines of continuous contour trenches was found to be 599.756 tonnes. Total silt deposited in all 12 loose boulder structures was found to be 30.99 tonnes over the period of 6 years after their construction. Total silt deposited in ENBs was found to be 1880.90 tonnes over a period of 6 years after their construction. The average soil loss from the catchment area of each ENB A, B, C, D and E was found to be 1.358, 1.172, 1.39, 1.07 and 0.75 tonnes/ha/year, respectively, where as storage capacity of all these reduced in the range of 7.9 to 11.49 %. Total silt deposited in all three CNB was found to be 1190.0 tonnes over the period of 3 years after their construction. The average annual soil loss from the catchment area of each CNB 1, 2 and 3 was found to be 1.036, 0.501 and 0.384 tonnes/ha/year, respectively, where as storage capacity of all these CNB's reduced in the range of 8.50 to 16.53 %.

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