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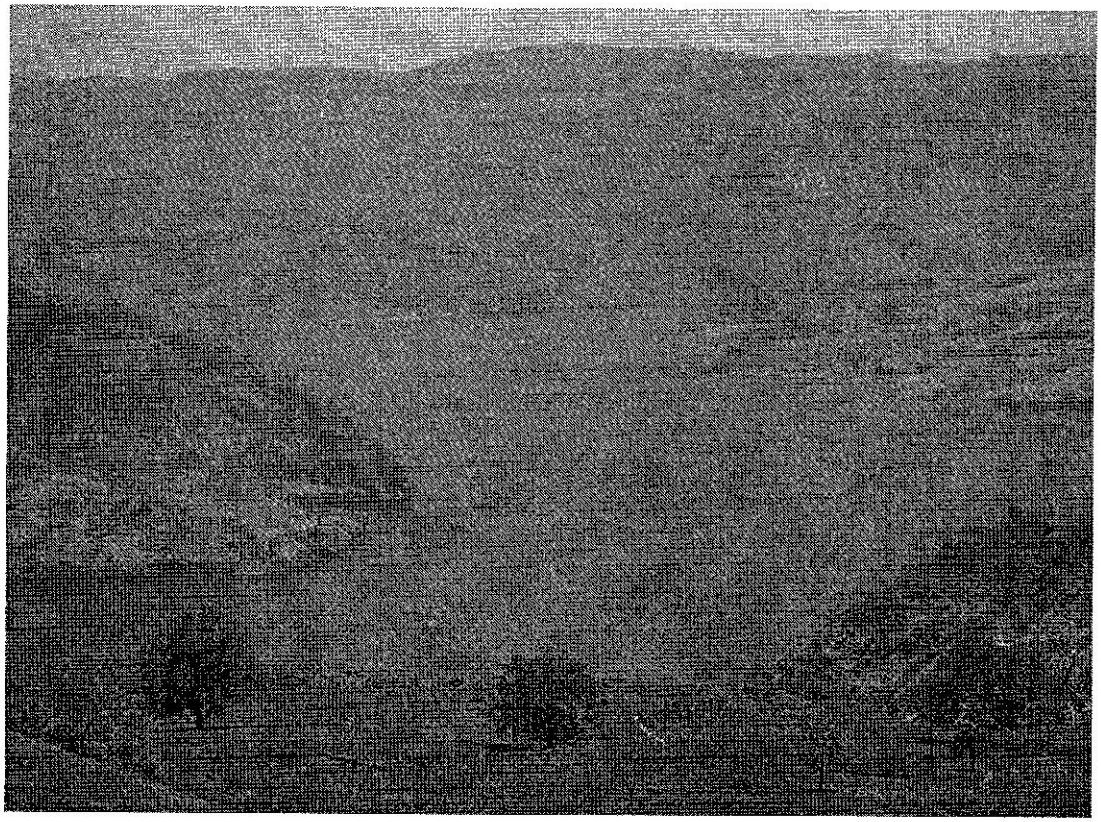
Monitoring treated Catchment for their hydrological behaviour in terms of runoff and soil loss in SSP, Maharashtra

Interim Report

2008-09



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CENTRAL SOIL & WATER CONSERVATION RESEARCH & TRAINING INSTITUTE

(INDIAN COUNCIL OF AGRICULTURAL RESEARCH)

Research Centre, Vasad - 388306, Dist: Anand (Gujarat)

Introduction

Narmada is the fifth largest river in India and largest west flowing river of Indian peninsula originating from Maikala ranges at Amarkantak in Madhya Pradesh at an elevation of 900 m . It flows westwards over a length of 1,312 km before draining into the Gulf of Cambay, 50 km west of Bharuch city. The basin lies between east longitudes 72° 32 and 81° 45' and north latitudes 21° 20' and 23° 45'. Vindhya hills in the north, Satpura ranges in the south, Maikala ranges in the east and the Arabian sea in the west form the boundaries of the basin. The basin has an elongated shape almost like a thin ribbon with a maximum length of 953 km east to west and a maximum width of 234 km north to south. The first 1,077 km of the river flows in Madhya Pradesh and the next 35 km stretch of the river forms the boundary between the State of Madhya Pradesh and Maharashtra. Again for the next 39 km, it forms the boundary between Maharashtra and Gujarat. The last stretch of 161 km lies in Gujarat. Out of the total Catchment area of about 1 Lakh sq. km 87% lies in Madhya Pradesh, 2% in Maharashtra and 11% in Gujarat.

The reservoir capacity is dependent on the rate of sedimentation and runoff from adjoining catchment area, for which Narmada authority have been pressing hard on extensive catchment treatment to reduce sediment yield to the reservoir. In the process SSP, Maharashtra had carried out soil and water conservation activities such as plantation, imposing conservation structures etc. of varying intensity to treat the catchment. To measure the effectiveness of extensive treatment works undertaken in the catchment area of SSP lying within Maharashtra, a project was initiated during 2006 after signing a MoU between CCF(T) Dhule Maharashtra (client) and CSWCRTI (ICAR), Dehradun (Consultant) through its regional Centre, Vasad (Gujarat).

Two micro watersheds have been identified for sample gauging by the CSWCRTI, RC, Vasad in consultation with SSP forest division, Dhule based on rainfall, soils, plantation intensity and drainage characteristic etc. The boundaries of two watersheds have been surveyed and mapped. The details of two sample watershed under study are given below:

Name of micro watersheds	Division	Longitude*	Latitude*
Akwani	Shahada	74°07'11.50"E	21°52'35.50"N
Gaman	Mewasi	73°55'11.52"E	21°48'28.41"N

C. Hydrological Survey of Watersheds:

The survey of watersheds for boundaries and drainage channels were carried out using Differential Global Positioning System (DGPS)/ SOI Map sheet and Google earth. The physiographic details of the two watersheds are given in Table 1.

Table.1. Physiographic details of the micro-watersheds.

Sl.No.	Name of watershed	Area (ha)
1	Akwani	282
2	Gaman	168

Soils of Gaman and Akwani watersheds

Soils from two depths of top, middle and bottom zone of Gaman and Akwani watersheds were analyzed to know the manifestation of soil physicochemical properties in terms of runoff and sediment generating potential. Soil texture of top, middle and bottom zone of Gaman watershed are clay loam, loam and loamy sand respectively while for the same zone in Akwani the texture are loam, sandy loam and loamy sand for the same zone. In both the watersheds there is clear textural transition from top to bottom with finer texture of top zone.

Organic carbon content of top as well as middle zone of both the watersheds is > 0.75 % ((0.75 to 0.94) but in bottom zone it is very low (0.1 to 0.18 %) without any transition with depth (Fig.1). Higher organic carbon in top and middle zone at both depths (0-15cm and 15-30 cm) is mainly due to addition by permanent vegetation and greater protection due to finer texture. Prominent channeling and washing effect towards bottom led to low organic carbon in bottom zone of watersheds.

Available K_2O and P_2O_5 in top zone of both watersheds are relatively higher than middle and bottom zone (Fig 2 & 3). This trend is also attributed to addition by permanent vegetation and protection due to finer texture. The trend of distribution of available K_2O and P_2O_5 in Akwani is generally observed in convex watersheds.

pH and EC of all three zones of soil in both watersheds are well within normal limit for any activities (Fig 4 & 5). Relatively lower pH and EC in top and middle zone of Gaman watersheds shows washing out effects of bases from these zone this type of distribution is generally observed in concave watersheds. Akwani watershed has got base rich soil on top and middle zone as compare to bottom soil which is in conformity of convex shape with extended upper plateau.

Bulk density of soils in both the watersheds are lower to higher from top to bottom zone (Fig. 6) well explained by texture of soil but presence of significant amount of gravel (11 to 18%) also had significant influence. Available water capacity (Fig. 7) as well as saturation moisture percent (Fig. 9) are higher at top and gradually reduce towards bottom and can be well explained in terms of texture and organic carbon of respective zones.

Saturated hydraulic conductivity which is governed by multitude of soil physical and chemical properties described in earlier section is lower in top zone and increases towards bottom zone (Fig. 8). Though the ruoff and sediment is governed by many factors viz, soil type, slope, vegetation and rainfall pattern but relatively lower hydraulic conductivity on top zone of Gaman watershed indicates higher runoff generating potential as compared to Akwani. Similarly loam texture of Akwani may yield more sediment under similar runoff. Presences of significant amount of gravel in soil further modify the physical condition of soil.

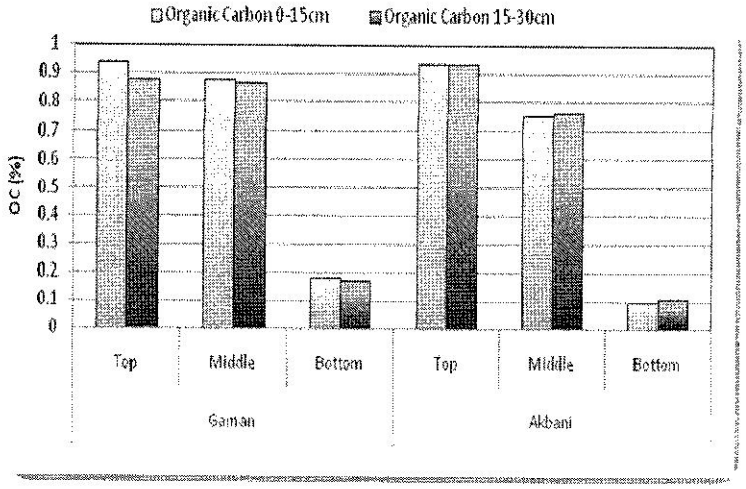


Fig.1 Organic carbon content (%) of soils at two depths (0-15 cm and 15-30 cm) of top, middle and bottom zone of Gaman and Akwani watersheds.

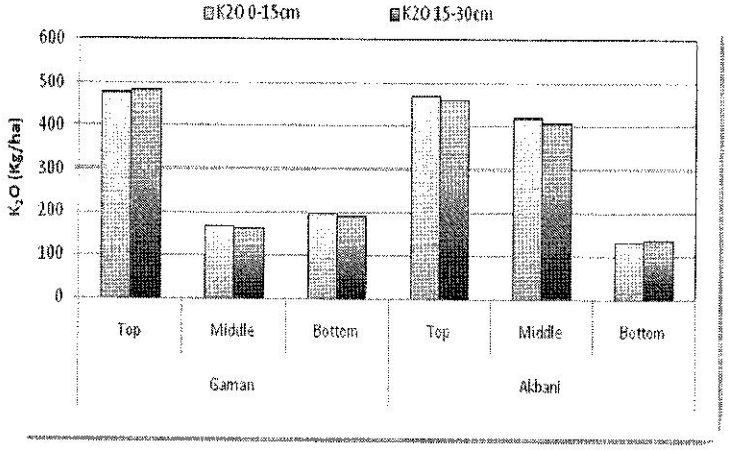


Fig 2. Available K_2O (Kg/ha) of soils at two depths (0-15 cm and 15-30 cm) of top, middle and bottom zone of Gaman and Akwani watersheds

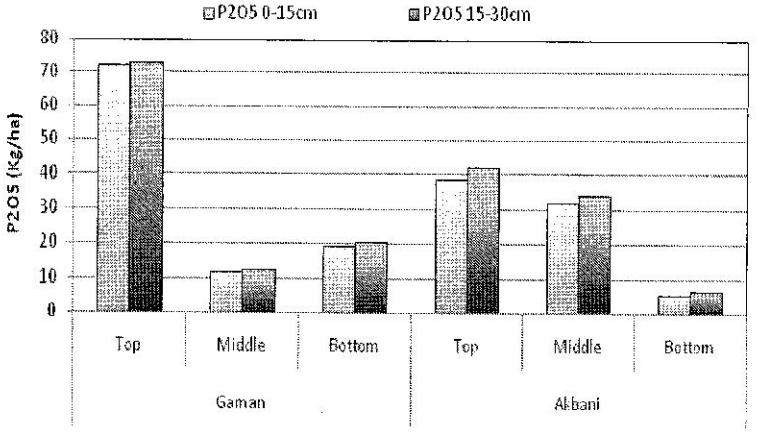


Fig 3. Available P_2O_5 (Kg/ha) of soils at two depths (0-15 cm and 15-30 cm) of top, middle and bottom zone of Gaman and Akwani watersheds

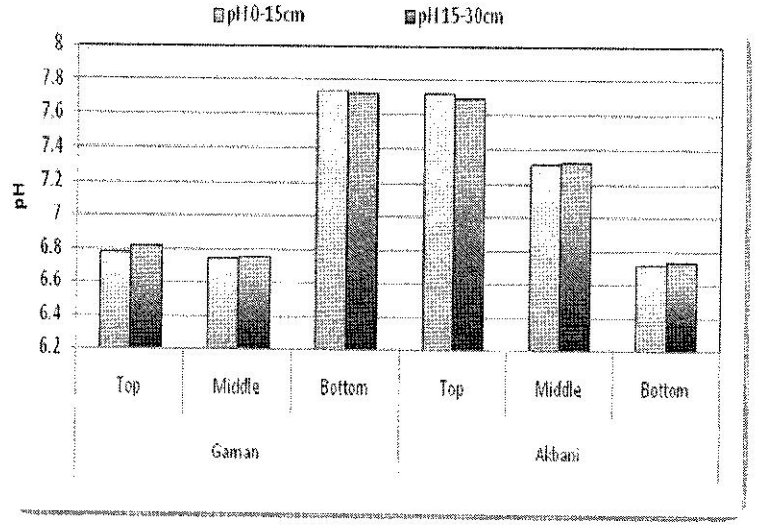


Fig 4. pH of soils at two depths (0-15 cm and 15-30 cm) of top, middle and bottom zone of Gaman and Akwani watersheds.

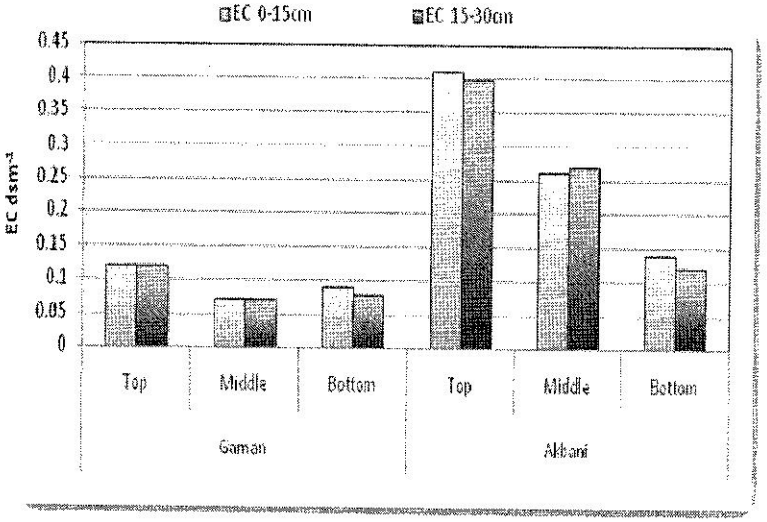


Fig 5. Electrical conductivity (dsm^{-1}) of soils at two depths (0-15 cm and 15-30 cm) of top, middle and bottom zone of Gaman and Akwani watersheds.

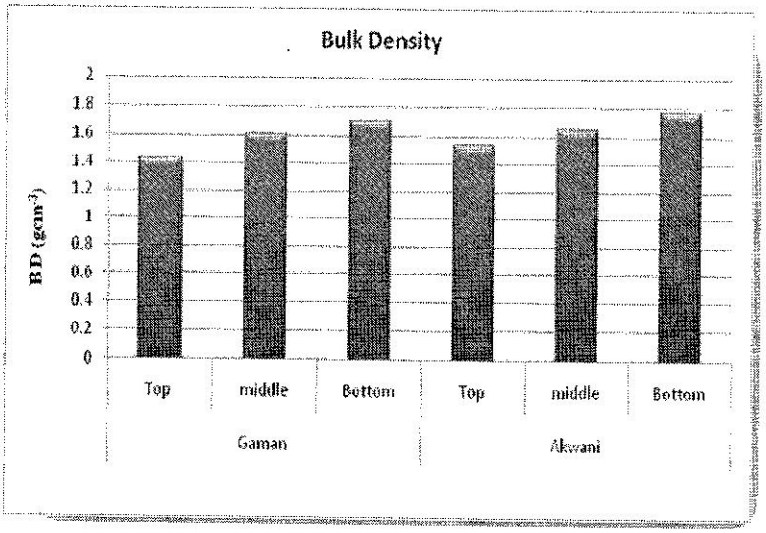


Fig 6. Bulk density (gcm^{-3}) of surface soil s (0-15 cm) of top, middle and bottom zone of Gaman and Akwani watersheds.

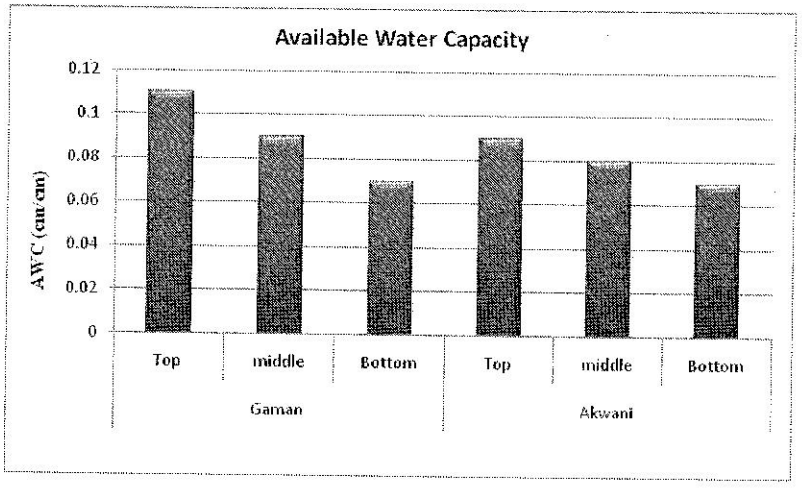


Fig 7. Available water capacity (cm cm^{-1}) of surface soil s (0-15 cm) of top, middle and bottom zone of Gaman and Akwani watersheds

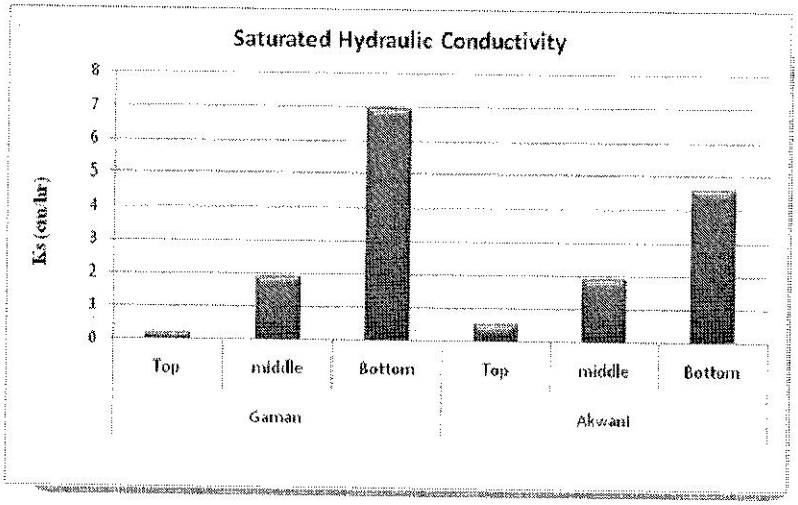


Fig 8. Saturated hydraulic conductivity (cm hr^{-1}) of surface soil s (0-15 cm) of top, middle and bottom zone of Gaman and Akwani watersheds

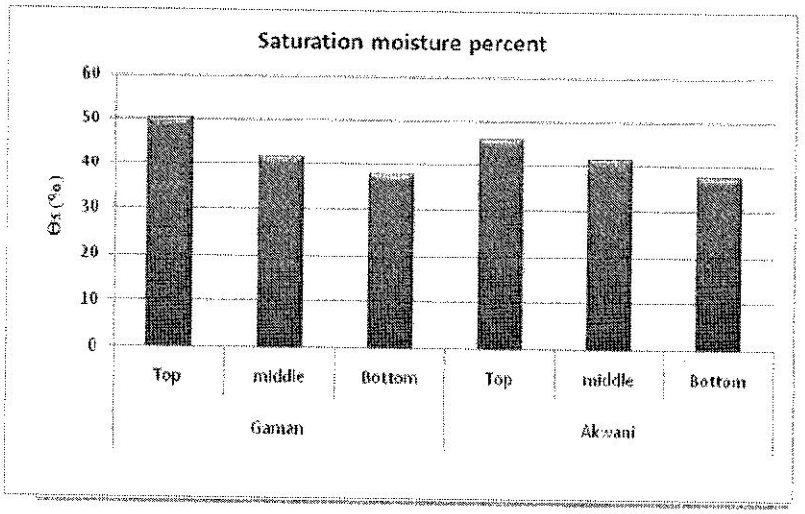


Fig 9. Saturation moisture content (%) of surface soil s (0-15 cm) of top, middle and bottom zone of Gaman and Akwani watersheds

Vegetation composition, distribution and diversity

The survey for vegetation was done by laying 10m X 10m quadrats at different locations such as slope, hump and bottom of the hills depending upon the topography. Most of the quadrats were, however, on slopes. Measurement on trees (top story) were taken in the 10m X 10m size quadrats, while the measurements on shrubs (mid story) were taken from two 5m X 5m quadrats within the 10m X 10m quadrat. The vegetation survey in the quadrats revealed the general trend of vegetation of different storey as under,

Quadrat studies

(a) Gaman

Total trees worked out to be 600/ha with predominance of *Holoptelia integrifolia* (32.4%) followed by *Butea monosperma* (24.3%) and *Wrightia tinctoria* (21.6%) and *Tectona grandis* (21.6%), each. The trees occupied 45.1 m^2/ha basal area, with maximum basal area of *Butea monosperma* followed by *Wrightia tinctoria* and *Holoptelia integrifolia* among all species. The top story had good canopy cover. Among the species, *Butea monosperma* and *Wrightia tinctoria* had regular distribution (Abundance to Frequency ratio being less than 0.025), while *Tectona grandis* had random distribution (A/F ratio being 0.04) and *Holoptelia integrifolia* had contagious distribution (A/F ratio being 0.12). *Butea monosperma* had highest Importance Value Index (140.57), followed by *Wrightia tinctoria* (90.10).

In the middle storey, small vegetation occupied total basal area of 4.60 m^2/ha, with maximum basal area of *Annona squamosa* (37.5%) followed by *Dendrocalamus strictus* (22.6%). The most predominant species was *Wrightia tinctoria* (IVI – 118.42), followed by *Butea monosperma* (IVI-45.56). Except for *Dendrocalamus strictus* and *Wrightia tinctoria*, which had contagious distribution, all other species were observed to have random distribution in the watershed.

(b) Akwani

The data collected on vegetation diversity from selected quadrats revealed that in the top storey, the trees occupied 36.9 m^2/ha basal area, with maximum number of trees of *Tectona grandis* among all species. The top story was observed to have good canopy cover, though it did not completely cover the ground. In terms of vegetation predominance, the Importance Value Index (IVI) revealed the highest index value for *Wrightia tinctoria* (71.26), followed by *Tectona grandis* (65.65). In terms of species distribution, almost all species had random distribution.

In the middle storey, small vegetation occupied very little basal area of 0.42 m^2/ha, with maximum number of shrubs of *Adina cordifolia* and *Tectona grandis*. Among the basal area of all the species, these two species had occupied the maximum area (35.7%). *Adina cordifolia* and *Tectona grandis* had the maximum Importance Value Index (62.38) also, suggesting predominance of these two species in the middle cover. Almost all the species in the middle storey were observed to have contagious distribution in the watershed.

Result and discussion

The vegetation species, at the top and medium story, with high canopy coverage along with high presence and contagious (clumped) distribution might have implications for better rainfall interception. This, with factors like basal area and grass coverage at ground level, could explain the pattern of run-off and soil loss at different sites.

Gaman

Total area of Gaman sub-watershed is 168 ha, which comprises of mixed forest, scrub forest, cultivated fallow and rock outcrop (Table 2). Total area under mixed forest is 102 ha. The observations based on quadrats data were projected to the whole area under mixed forest. Total number of trees, thus, was estimated to be 61194 during the period of survey. *Holoptelia integrifolia* (19847 Nos.) followed by *Butea monosperma* (14884 Nos.) and *Wrightia tinctoria* and *Tectona grandis* (13231 each) were found to have maximum presence in the sub watershed studied. The species are deciduous in nature. Canopy area of trees was observed to be overlapping, though estimation was attempted for different trees. At the time of survey trees' canopy had completely covered the ground. *Butea monosperma* (46.3 ha) had highest canopy coverage in the mixed forest, *Tectona grandis* (18.1 ha) had lowest canopy coverage. While former species appears to have regular distribution and the later species has shown random distribution in the watershed. On the other hand, *Holoptelia integrifolia* exhibited clumped distribution but had medium canopy coverage. So, the top story exhibited a mixed trend of vegetation dominance and canopy coverage. Trees occupied total basal area of 4600 m^2 in the sub-watershed. Of this, about half is accounted for by *Butea monosperma* (Figure 1).

Similar mixed trend was observed in the mid story. Total shrubs were estimated to be 321300 in the Gaman mixed forest area. In the mid story, while *Wrightia tinctoria* (104125 Nos.) was observed to have maximum presence with clumped (contagious) distribution its canopy coverage (1.05 ha) was low in the sub-watershed. On the other hand, *Anona squamosa* had highest canopy cover (3.29 ha) but poor presence (11900 Nos.) in the watershed. Its distribution, in the watershed, was also random.

Table 2: Land use classification in Gaman watershed

S. No.	Land use type	Area (ha)
1	Mixed forest	102
2	Scrub forest	39
3	Cultivated fallow	22
4	Rock out crop/ degraded land	5
	Total	168

Akwani

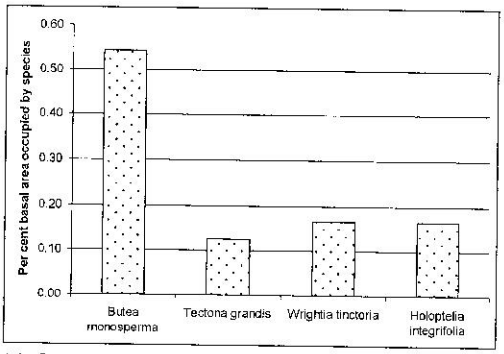
Total area of this sub-watershed is 262 ha (Table 3). Of this, 110 ha is degraded forest, 99 ha scrub land, 43 ha is rocky barren land and 10 ha is agricultural land. Quadrats studies were done in forest area. The total canopy cover occupied by trees was estimated to be 96.9 ha. In this watershed also, *Tectona grandis* (18586 Nos.) followed by *Wrightia tinctoria* (15931 Nos.) had maximum presence but while former had comparatively lower canopy cover (9.4 ha), the later species had medium canopy (13.7 ha) at the top story. On the other hand, species like Moyani had comparatively higher canopy coverage (25.0 ha) but low presence (5310 Nos.) in the watershed. The total basal area occupied by the trees was 4059 m^2.

In the mid story, *Adina cordifolia* and *Tectona grandis* each had high presence (35357 Nos.) but both these species exhibited low canopy cover (0.7 ha and 0.3 ha, respectively). These species showed a clumped distribution. But due to poor canopy cover might not have contributed much to rainfall interception. The species like *Diospyros melanoxylon* exhibited clumped distribution but were observed to have lower presence (18857 Nos.) and canopy cover (0.6 ha). Over all, a mixed

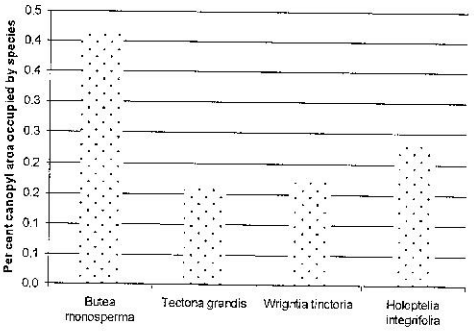
type of trend was observed in the distribution and canopy cover of the species. Hence, their contribution to rainfall interception can not be clearly ascertained.

Table 3: Land use classification in Akwani watershed

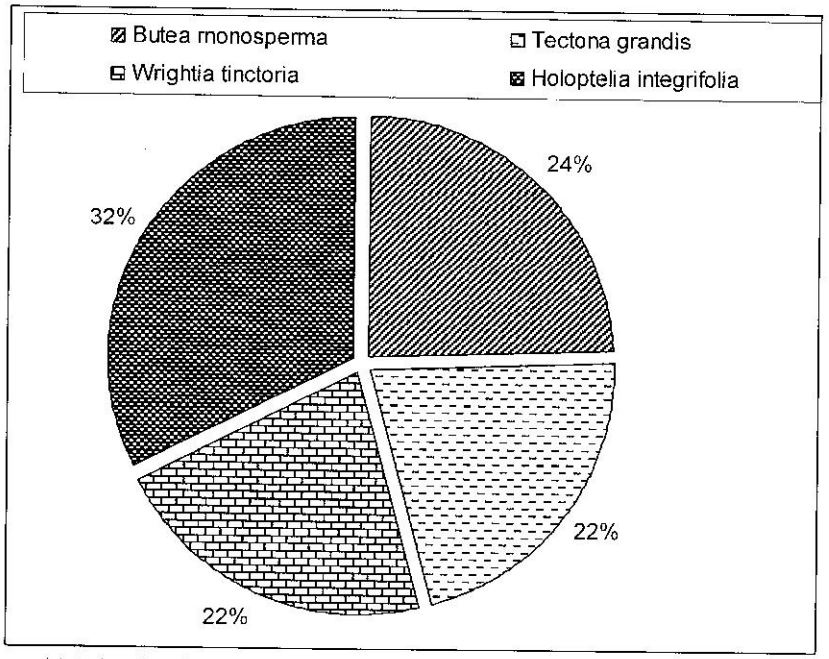
S. No.	Land use type	Area (ha)
1	Rocky barren land	53
2	Degraded forest with ground vegetation	110
3	Agricultural barren land	20
4	Scrub land with ground vegetation	99
	Total	282



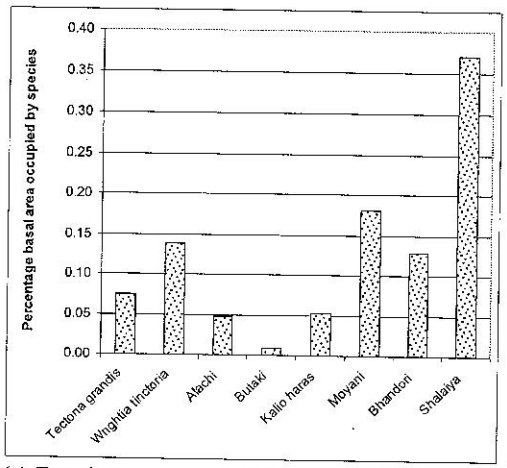
(a) Basal area occupied by species (%)



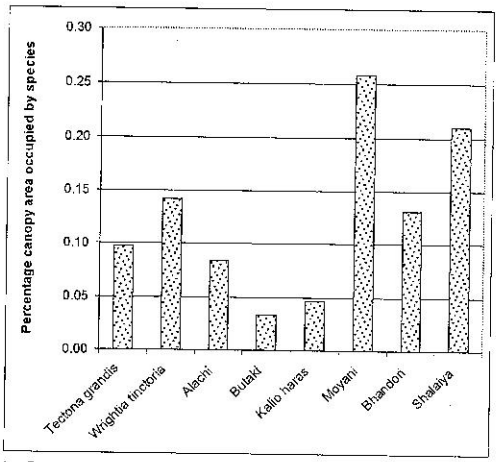
(b) Canopy area occupied by species (%)



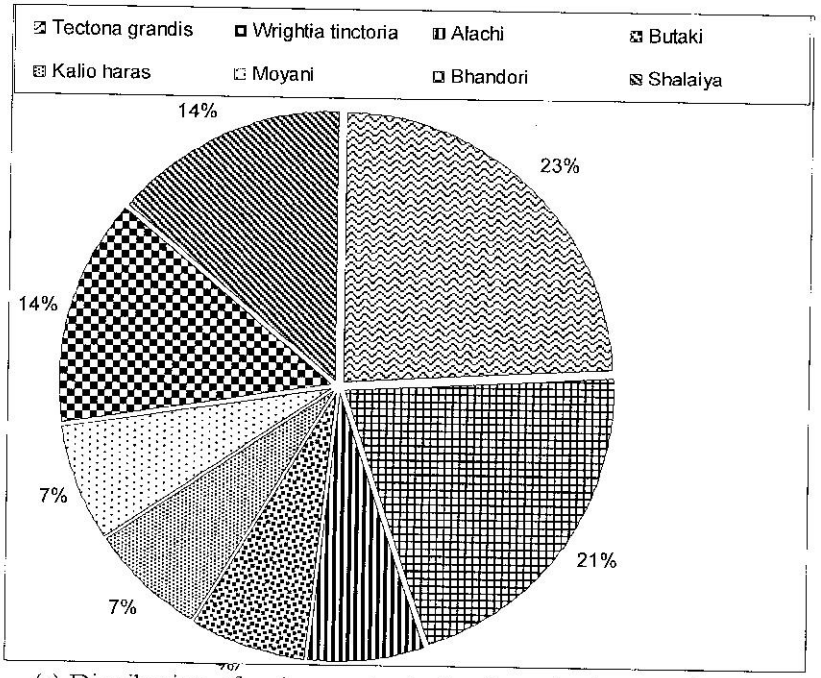
(c) Distribution of major species in the Gaman sub-watershed (%)



(a) Basal area occupied by species (%)



(b) Canopy area occupied by species (%)



(c) Distribution of major species in the Akwani sub-watershed (%)

D. Installation of Hydrologic Instruments:

The design of estimate (weir) prepared and finalized by the CSWCRTI for two gauging sites. The constructions of gauging weir as well as observers' shelter cabin has been done / erected at both the sites during 2006-07 and observers to be posted at site by the client have been selected as per MoU. A lower level training to observers has been arranged as well supervisory staff of SSP who has been deputed / posted at two gauging sites. The observers' kits distributed to individual observers performing duty. Instruments viz. ordinary and automatic rain gauge, stage level recorder, digital water level recorders (DWLR) have been procured by the consultant and installed at the two sites during current rainy season 2007 and 2008.

Landuse Map of Gaman watershed

Legend

- Mixed Forest
- Scrub Forest
- Cultivated Fallow
- Rock Out crop/ degarded land

0 100 200 400 600 800
Meters

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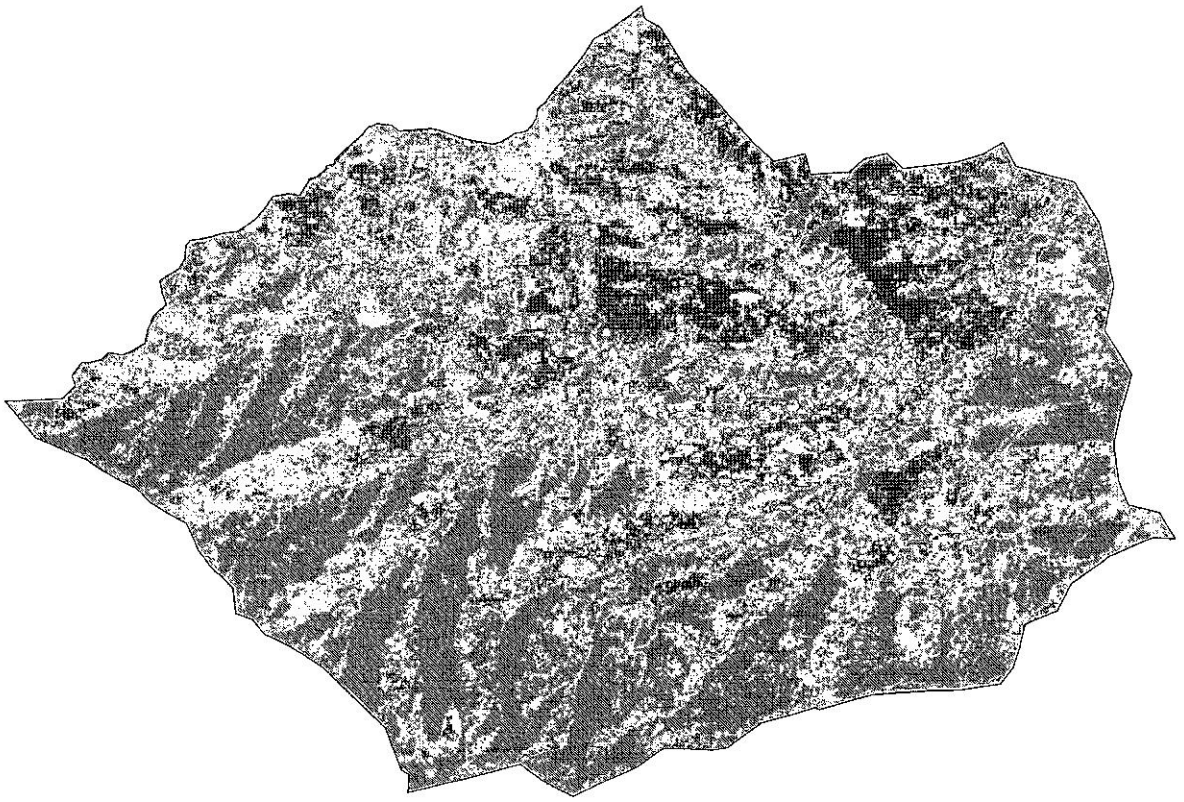
Landuse Map of Akwani Watershed



Land use

- Scrub land with ground cover
- Rocky barren land
- Degraded forest with ground vegetation
- Agricultural Barren land

0 125 250 500 750 1,000
Meters

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Data collection on rainfall, runoff and sediment has been done at both the sites in the preceding monsoon season.

Collection of Rainfall, Runoff and Sediment yield data

Rainfall data was collected using both recording and standard rain gauges. The daily continuous record of runoff was made using Stage level recorders (SLRs) and DWLRs. Sediment load/ yield data was calculated from sediment samples collected during a scheduled interval during runoff events. The data collected from two micro-watersheds have been analyzed. The annual rainfall data collected by the observers were not found consistent for the year as they failed to record it properly as per the training imparted to them at both the sites. Therefore, rainfall data from the nearby stations will be utilized for analysis. Moreover the second year saw a different group of observers at both the sites and were not suitably educated to collect data.

The data analysis was carried out using the runoff charts from installed SLRs. The data of DWLR was not continuous due to non-charging of battery at the remote site. The solar panel was removed frequently to avoid theft of the unit and in the process affected the data continuity.

Rainfall, runoff and sediment analysis of the two micro-watersheds:

Table 4. Runoff and Sediment yield from Gaman watershed 2007

Date	*Rainfall (mm)*	*Runoff (mm)*	*% of rainfall (%)*	*Sediment yield (t/ha)*
30-Jun-07	334.40	>30.96	>9.26	>0.68
01-Jul-07	100.20	>22.02	>21.98	>0.28
03-Jul-07	77.00	25.11	32.61	0.28
09-Jul-07	93.30	24.87	26.66	NA
17-Aug-07	NA	5.09	NA	NA
21-Aug-07	220.00	33.32	15.14	0.60
25-Aug-07	2.60	0.70	26.82	0.00
26-Aug-07	NA	4.46	NA	0.01
27-Aug-07	NA	28.73	NA	0.19
29-Aug-07	11.80	0.01	0.07	0.00
01-Sep-07	57.00	0.32	0.55	0.01
03-Sep-07	NA	1.03	NA	0.03
05-Sep-07	38.20	11.33	29.65	0.09
24-Sep-07	29.60	7.15	24.16	0.04
25-Sep-07	0.00	6.82	NA	0.02
	>964.10	**>201.92**	**>20.94%**	**>2.22**

(Few rainfall events were collected from a nearby station at Kokam-II and Kokam-I in Gujarat having similar areal characteristics. However uncertainty of rainfall pattern in hilly terrain not all missing events could be used. Some extreme events could not be recorded over the full time base, therefore partially analysed)

Table 5. Runoff and Sediment yield from Gaman watershed 2008

Date	Rainfall (mm)	Runoff (mm)	% of rainfall (%)	Sediment yield (t/ha)
13-07-2008	35.6	3.0	8.5	NA
14-07-2008	3.1	0.0	0.1	NA
16-07-2008	3.1	0.1	3.9	NA
11-08-2008	174.8	30.1	17.2	0.07
13-08-2008	30.9	9.3	30.2	NA
14-08-2008	16.4	0.2	1.0	NA
15-08-2008	9.0	0.1	0.9	NA
06-09-2008	25.2	4.7	18.6	0.05
08-09-2008	38.0	8.5	22.5	0.13
09-09-2008	25.2	7.4	29.2	0.12
11-09-2008	39.6	8.7	21.9	0.07
13-07-2008	35.6	3.0	8.5	NA
14-07-2008	3.1	0.0	0.1	NA
16-07-2008	3.1	0.1	3.9	NA
11-08-2008	174.8	30.1	17.2	0.07
	>400.9	**>72.1**	**~18%**	**>0.44**

(Many events as usually lost this year too. The DWLR data too discontinuous due to displacement of solar panel)

Table 6. Runoff and Sediment yield from Akwani watershed 2007

Date	Rainfall (mm)	Runoff (mm)	% of rainfall (%)	Sediment yield (t/ha)
26-Aug-07	3.00	0.04	1.30	NA
27-Aug-07	6.40	0.00	0.06	0.0000
28-Aug-07	27.00	2.47	9.13	0.0051
30-Aug-07	6.40	0.01	0.20	0.0001
01-Sep-07	15.20	0.40	2.61	0.0064
05-Sep-07	21.40	0.90	4.20	0.0006
18-Sep-07	13.00	0.83	6.36	NA
19-Sep-07	17.60	0.90	5.10	NA
20-Sep-07	15.30	1.10	7.22	NA
21-Sep-07	15.80	0.84	5.32	NA
24-Sep-07	35.00	5.56	15.87	NA
25-Sep-07	32.00	6.15	19.22	0.1006
	>208.10	**>19.19**	**>9.2**	**>0.1100**

(Events could not be recorded before 26 august 07 as due to an event of 234 mm in one day the structure was badly damaged due to excessive bed load (stones). The SLR assembly was washed away with that event.)

Table 7. Runoff and Sediment yield from Akwani watershed 2008

Date	Rainfall (mm)	Runoff (mm)	% of rainfall (%)	Sediment yield (t/ha)
27-Jul-08	24.40	1.28	5.25	0.01
26-Aug-08	50.60	10.79	21.32	NA
04-Sep-08	24.20	2.48	10.24	0.03
05-Sep-08	95.40	8.24	8.63	0.12

08-Sep-08	32.00	6.74	21.05	0.06
13-Sep-08	34.10	4.93	14.46	0.12
19-Sep-08	39.00	6.45	16.54	0.03
	>299.7	**>40.91**	**~13.65**	**>0.37**

(The DWLR data could not retrieved from the system due malfunction of the display unit. Efforts are on to retrieve the data)

General Observation:

- Gaman falls in the high rainfall zone and predictably prone to more sediment yield. The bed load is very heavy comprising of large stones that carried out with heavy runoff. Due to fragile geological system this detachment of stones are very much a problem.

- Akwani, However, is relatively much milder in producing suspended sediment. However, large stone detachment is a major problem. In the initial period of study there was a deposition of large bed load of about 5' behind the structure, causing damage to the weir structure.

Works to be reported in the final report

- Analysis for missed events interpolated/ extrapolated from known events to predict the annual runoff and sediment yield position of both the watershed.

Socio-Economic and Psychological Status of Tribals in SSP Catchment Area

The research study on socio-economic and psychological status of tribal farmers was conducted in the two selected watersheds in tribal area of Nandurbar district of Maharashtra during 2008 under the consultancy research project on "Monitoring treated catchment for their hydrological behaviour in terms of runoff and soil loss in SSP, Maharashtra" was taken by the CS & WCR & TI, Research Centre, Vasad for two years during 2008 –2009 from Chief Conservator of Forests (T), Ram Manohar Lohia Marg, Near SRPF ground, Dhule, Maharashtra. The watershed selected were i) Akwani watershed situated in Roshmal khurd panchayat, taluka Dhadgaon and ii) Gaman watershed situated in Sindhuri panchayat, taluka Akalkunwa in Nandurbar district of Maharashtra. All the farmers residing in the selected watersheds were considered as respondents for the study. Thus, total 43 respondents were included in the study comprising 22 respondents from Akwani watershed and 21 respondents from Gaman watershed. The responses of the respondents were recorded in the developed structured schedules through personal interview method. Suitable statistical techniques were used to draw inferences from the data.

Personal traits of tribals

Table 8: Personal profile of the tribal farmers of Nandurbar district in Maharashtra.

(N=43)

Sl. No.	Particulars	Frequency	Per Cent
1.	**Age**		
	Young (25 – 40)	23	53.48
	Middle (41 – 55)	16	37.20
	Old (56 – 70)	4	9.30
2.	**Land holding**		
	Marginal farmers	10	23.25
	Small farmers	24	55.81
	Medium farmers	9	20.93

	Large farmers	-	-
3.	**Education**		
	Illiterate	40	93.02
	Can read only	2	4.65
	Can read and write	1	2.32
	Primary	-	-
4.	**Occupation**		
	Labour	43	100
	Cultivation	43	100
	Business	-	-
	Service	-	-
5.	**Family type**		
	Nuclear	40	93.02
	Joint	3	6.97
6.	**Family size**		
	Upto 5 members	1	2.32
	6 to 10	34	79.06
	>10 members	8	18.60
7.	**Annual income**		
	Upto 5000	33	76.74
	5001 to 10000	9	20.93
	>10000	1	2.32

The socio-economic profile of the tribal farmers (table 8) reveals that amongst the selected tribal farmers, 53.48 per cent were of young age, 37.20 per cent of middle age and only 9.30 per cent of old age. All the farmers were belong to schedule tribe cast. More than half of the tribal farmers (55.81 %) were small farmers, 23.25 per cent marginal farmers and 20.93 per cent medium farmers. None of the farmer having larger size of land holding in this area. Majority of the tribal farmers (93.02 %) were illiterate and only couple of tribals can read and write. None of farmer was having at least primary education standard. The major livelihood of the tribal farmers was depending on labour work and cultivation. The majority (93.02 %) of the tribal farmers were living in nuclear family and only few (6.97%) farmers in joint family. Majority (79.06%) of tribal farmers were having 6 to 10 family members in their family followed by 18.60 per cent having more than 10 members and only couple of per cent farmers having family members five or less. It was also revealed from the data that majority (76.74 %) tribal farmers were earning their annual income up to 5000 only and about one fifth of farmers having 5000 to 10000 and only couple of percent of farmers having more than 10000 annual income per year. The tribal farmers were earning their income by doing labour work in fields of other farmers.

Socio-Economic Status of tribals

Table 9: Socio-Economic Status of tribal farmers of Nandurbar district in Maharashtra.

N=43

Socio-Economic Status	Frequency	Per Cent
Low (Scores up to 27.66)	23	53.48
Moderate (27.67 to 45.32)	11	25.58
High (>62.98)	9	20.93

It was depicted from the table 9 that majority little more than fifty per cent of tribal farmers were having low level of socio-economic status and only about one fourth & one fifth of

tribal farmers were having moderate and high socio-economic status respectively. It revealed that majority of tribal farmers in Nandurbar district of Maharashtra were having low socio-economic status.

Dependence of tribal farmers on forest

Table 10: Distribution of the tribal farmers according to their dependence on forest.

(N=43)

Sl. No.	Particulars	Frequency	Per Cent
1.	**Firewood use from forest**		
	Upto 10 Kg/day	13	30.23
	11 to 15 Kg/day	19	44.18
	More than 15 Kg/day	11	25.58
2.	**Timber wood from forest**		
	Upto 25 Kg/year	10	23.25
	26 to 50 Kg/year	26	60.46
	More than 50 Kg/year	7	16.27
3.	**Mahuda flower**		
	Nil	7	16.27
	Upto 50 Kg/year	12	27.90
	51 to 100 Kg/year	11	25.58
	More than 100 Kg/year	13	30.23
4.	**Timbru Leaves**		
	Upto 5 Kg/year	22	51.16
	6 to 10 Kg/year	16	37.20
	More than 10 Kg/year	5	11.62

The table 10 revealed that about 50 per cent of tribal farmers were using 11 to 15 kg firewood per day followed by 30.23 per cent up to 10 kg and about one fourth of tribal farmers were using more than 15 kg per day for their domestic use. The majority of (60.46 %) tribals were bringing 26 to 50 kg timber wood per year, 23.25 per cent tribals using upto 25 kg. and only 16.27 per cent using more than 50 kg. of timber wood from forest for their domestic use. The farmers were also collecting Mahuda flowers from forest area and their fields. Maximum 30.23 per cent of tribals were collecting more than 100 kg. Mahuda flowers per year and about one fourth of tribals collecting 51 to 100 kg and 27.90 per cent upto 50 kg per year. Tribal farmers were also used Timbru leaves for Bidi making for their smoking. Majority (51.16 %) tribals were collecting upto 5 kg dried Timbru leaves from the forest area followed by 37.20 per cent collecting 6 to 10 kg per year only 11.62 per cent collecting more than 10 kg Timbru leaves per year for their own family smoking.

Knowledge regarding SWC technologies

Table 11: Distribution of the tribal farmers according to their knowledge level regarding soil and water conservation technologies.

N=43

Knowledge levels	Frequency	Per Cents
Low level (<7.33 scores)	**13**	**30.23**
Moderate level (7.34 to 9.66 scores)	**19**	**44.18**
High level	**11**	**25.58**

(>9.66 scores)		

Majority 44.18 per cent of tribal farmers had moderate level of knowledge regarding soil and water conservation technologies, followed by 30.23 per cent of tribals having low level and about one fourth of tribals having high level of knowledge regarding soil and water conservation practices. Thus, it is revealed from the table 4 that the tribal farmers of Nandurbar district of Maharashtra were having moderate to low level of knowledge and understanding about different soil and water conservation technologies.

Adoption of SWC technologies:

Table 12: Distribution of the tribal farmers according to their adoption level of soil and water conservation technologies.

N=43

Adoption levels	Frequency	Per Cents
Low level (<4.66 scores)	**15**	**34.88**
Moderate level (4.67 to 6.32 scores)	**22**	**51.16**
High level (>6.33 scores)	**6**	**13.95**

About 50 per cent of tribal farmers had moderate level of adoption of different soil and water conservation technologies followed by 34.88 per cent of tribals having low level of adoption and only 13.95 per cent were having high level of adoption of soil and water conservation technologies in their fields. The table 12 shows that majority of tribal farmers in the Nandurbar district of Maharashtra were having moderate to low level of adoption of soil and water conservation technologies in their fields to conserve moisture and control soil erosion.

Conclusion

It can be concluded from the study that the tribal farmers were illiterate; having small land holdings; low income, big family size; lack of employment and such conditions were responsible for making them very poor with low socio-economic status. The poor tribal farmers were migrating into nearby areas for labour work in the fields of big farmers to earn their livelihood. The tribals were also very much dependent on forest in their nearby area for firewood, timber wood, Mahuda flowers and Timru leaves for their own domestic consumption to survive in their remote areas. It was also concluded that the tribal farmers were also facing lack of awareness about improved SWC technologies and low adoption level of SWC technologies.