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Model watershed - Maintenance Monitoring and Outreach

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Project code : KFRI 510/06

Title : Model watershed - Maintenance Monitoring and Out reach

Investigators : Dr S Sankar, Dr Thomas P Thomas and Sri. K K Unni

Funding Agency : Plan Fund

Project Period : 3 Years

Scheduled date of completion : December 2009

Objectives :

1. Maintain present works
2. Monitor the outflow from the model watershed, while establish a control gauging station in an untreated area within the campus
3. Continue planting with stress on hedges and alley cropping
4. Provide avenues for visitors and training to stakeholders

Budget : 3 Lakhs (One lakh per year)

Contents

Acknowledgement

This project is the outcome of a previous endeavour to create a Model Watershed in Kerala Forest Research Institute campus at Velupadam in 2005 under the Chief Minister's One year Programme. The authors are indebted to all who helped us in realising the dream in 2005. We are thankful to Dr JK Sharma, Former Director KFRI who suggested the theme and initiated the work in 2006. We are thankful to Dr R Gnanharan, Former Director and Dr KV Sankaran, Director, KFRI for support. The monitoring and maintenance were carried out by Sri TS Suresh and Sri Suresh to whom we are indebted. The draft was edited by Drs M Balagopalan, S Sandeep and Dr KK Seethalakshmi. The authors thank them for the scrutiny.

Introduction

Water is a vital natural resource which is indispensable for the existence of all living matter: plant, animal and man (Ullah *et al.,* 1972). From the very beginning of the history of mankind the need for water has attracted man to settle near riverbanks. All ancient civilizations of the world developed on the banks of rivers (Das, 1964). Today also, the availability of water influences to a considerable extent the pattern of land use and the social and economic well being of the people. Since water is a vital resource, the necessity for its conservation needs emphasis. To control the water yield and to improve the water resources, the proper approach is sound watershed management. Watershed integrates all the hydrological phenomena pertaining to its boundaries and as such is a logical unit for planning optimal development of soil and water resources (Holton, 1969).

The State of Kerala, although receives an annual rainfall of ca. 3000 mm is affected either by floods or droughts. This is due to the nature of the terrain with steep slope, absence of vegetative cover and intensive downpours of short duration. Conventional methods of creating reservoirs, dams, inter-basin transfers have failed to achieve the desired results on the one hand and cost the exchequer dearly on the other. In this context cost effective localised methods to control the flow of water and also to enhance infiltration gather importance. Although, such methods have been tested and tried at various places throughout the state, a demonstration area for experimenting and learning is visibly absent.

A watershed has five main functions. These functions are hydrological and ecological in nature.

Hydrological functions:

- Collect rainfall water

- Store water in various amounts and for different periods
- Release water as runoff

Ecological Functions:

- Provide conditions and sites for various bio-chemical reactions to take place
- Provide habitat to flora and fauna of various kinds

The role of watershed management in storing and controlling the release of water has not been demonstrated widely. The opportunity of having a model watershed with all possible soil and water conservation measures implemented was utilised and a control watershed (where no soil and water conservation measures) was identified in an adjacent area for comparison with the following objectives:

1. Maintain present works
2. Monitor the outflow from the model watershed, while establish a control gauging station in an untreated area within the campus
3. Continue planting with stress on hedges and alley cropping
4. Provide avenues for visitors and training to stakeholders

Study Area

The study was conducted in the Field Research Centre of the Institute at Velupadam (Fig.1). A small stream flowing out into the main road and the area draining into it was chosen. The Model watershed was established in 2005 (Sankar et al., 2006) and the Control watershed was taken adjacent to it in 2006 (Fig.2). The Model watershed has an area of 7.591 ha while the Control watershed an area of 5.436 ha (Fig.3)

Figure 1. Location of the Study Area

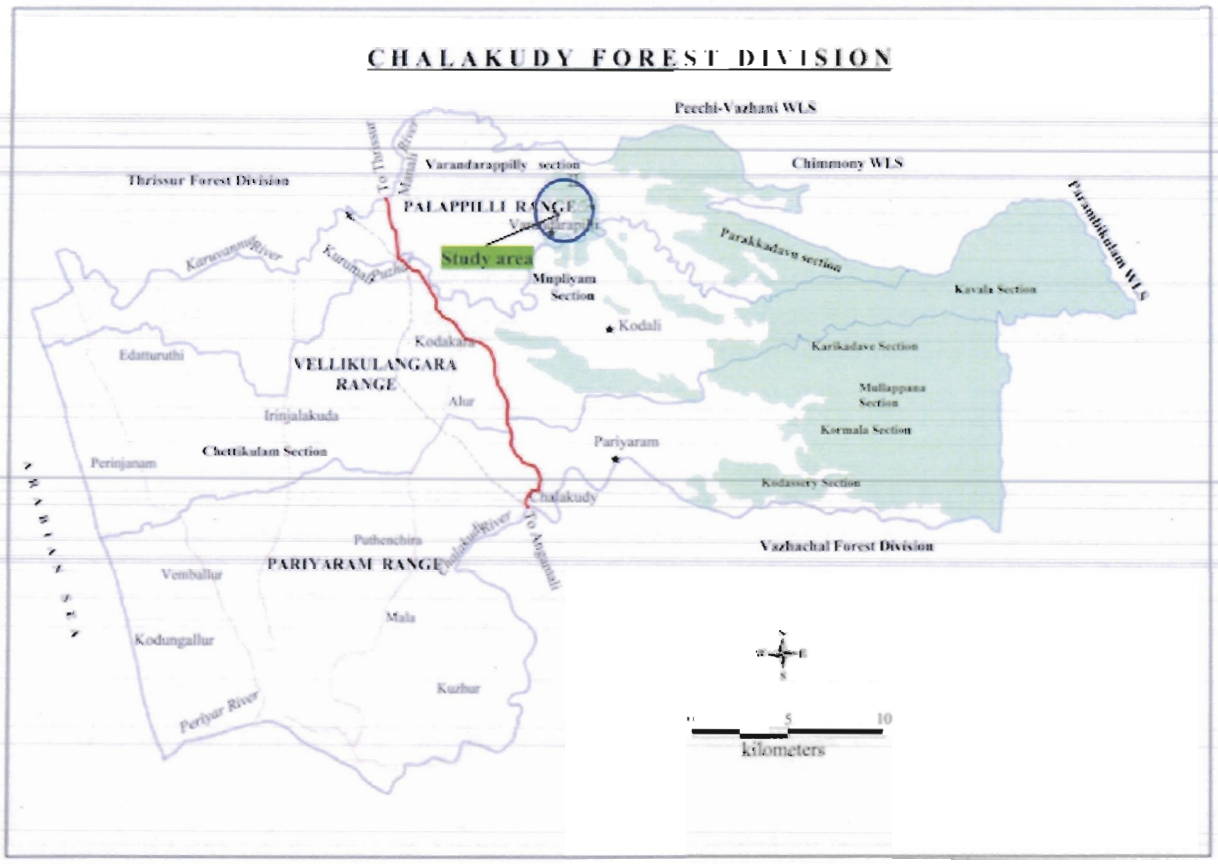


Figure 2. Location of Model and Control watersheds

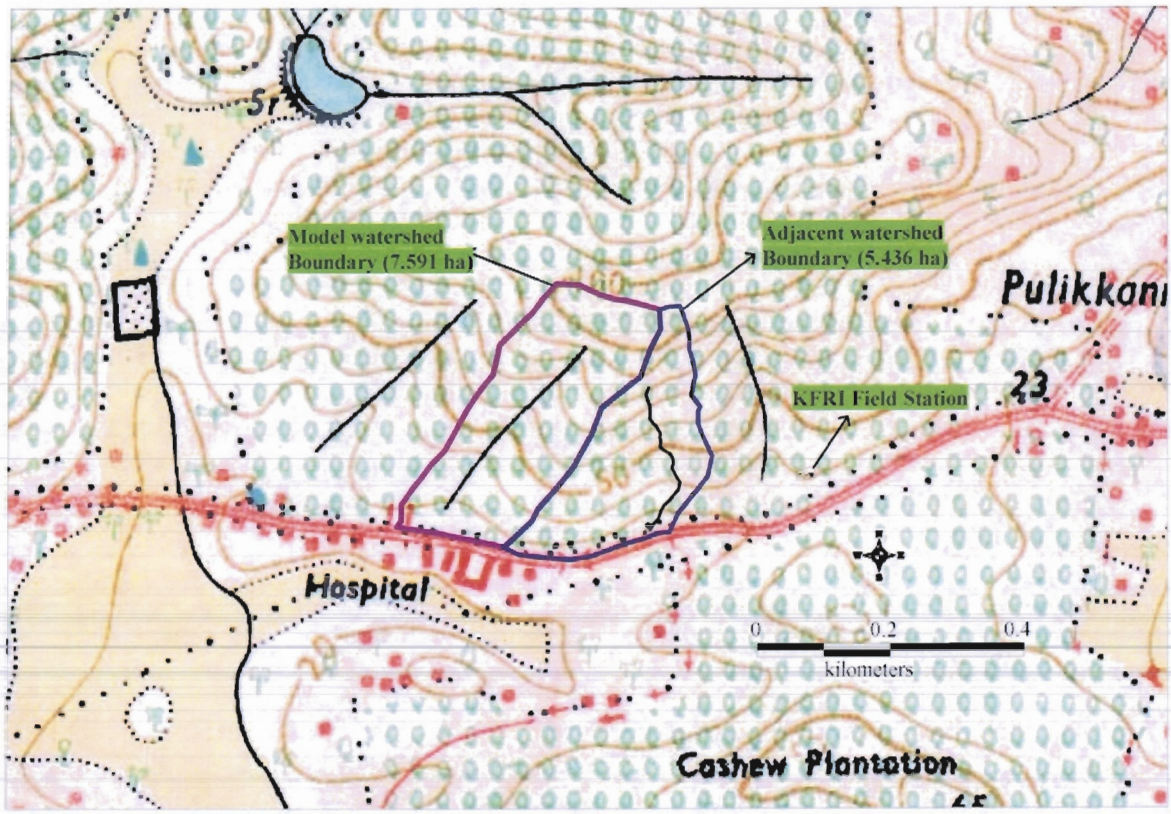
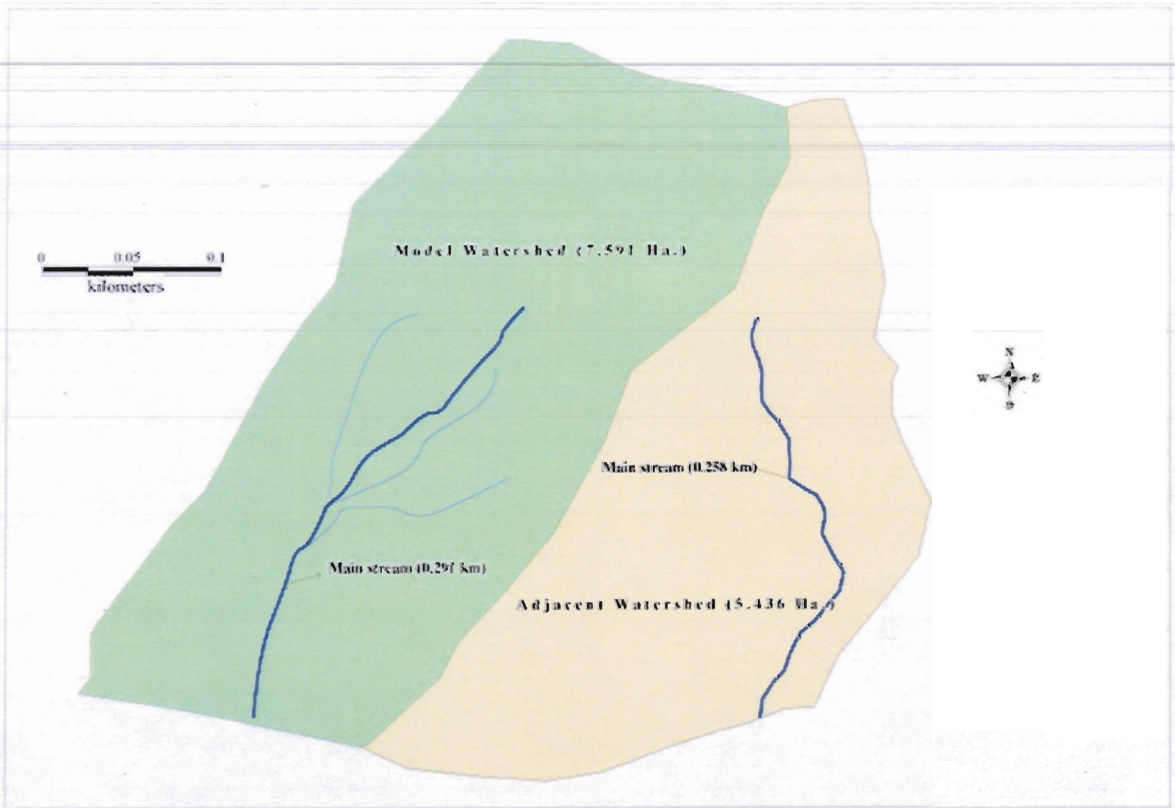


Figure 3. Shape and area of watersheds



Methods

Treatments: The model watershed was accorded both mechanical and vegetative treatments in 2005. During 2006-2009 no new treatments were added except maintenance of the same done in 2005 (Table1).

Table 1. List of mechanical structures

No	Structures	Number/ volume
1	Check dam	1
2	Cross-checks	3
3	Bamboo check dam	2
4	Dry log check dam	1
5	Dry rubble rock pack	104.48m^3
6	Dry rubble (local stone) pack work	39.87m^3
7	Contour bunds with packing in between	43.03m^3
8	Contour bunds	122.11 m^3
9	Contour trenches	630.50m
10	Moisture conservation pits	448

Rainfall and run-off

The most important criterion for characterising any watershed is the incident rainfall and the subsequent runoff from the watershed. The rainfall-runoff relationship indicates the health of the watershed. In degraded watersheds runoff is increased and floods and gullies are imminent during the rainy season. Rainfall in the watershed was measured at 8 AM daily using a FRP rain gauge (Plate 1). At the outlet of the watershed a gauging station (Plate 2) was constructed. The structure was 4 x 1.5 x 1 m in size (length, breadth, height). It was constructed using country bricks and plastered with cement. A metallic measuring scale with 2 cm graduation was fixed to measure the height of the flow of water. Days when flow of water was observed, the height and speed of the water (using float and stopwatch) was recorded six times daily. Flow is computed by:

Q(flow in m^3/s)= V(velocity)x A(cross section of flow)

Plate 1. Rain gauge

Plate 2. Gauging Station

Results and Discussion

Monitoring

The results of observations on rainfall and run off from control and model watersheds for years 2006-09 are presented in Tables 1-4 (Appendix). A consolidated table is provided below (Table 2). Annual run off is calculated by averaging the monthly run off data (Tables 1-4).

Table 2. Annual runoff (%) from watersheds

Type of watershed	2006	2007	2008	2009
Control	27.1	27.6	25.6	28.1
Model	7.9	19.6	11.36	17.5

The runoff from the two watersheds indicates that the same has been controlled in the model watershed where soil and moisture conservation measures have been undertaken. In the model watershed runoff varies from 7.9 to19.6%. This is justified either by intensity of rainfall or non maintenance annually of certain structures (trenches and bunds). On the other hand there is intense runoff from control watershed to the tune of 28%.

Outreach

Both Model and Control watersheds have been a platform for extension and education. Many watershed teams from all over the State visited and learned from here (Watershed teams from Thalapulam, Theekoyi, Alamgode and Kayyor grama panchayaths). Officials and stakeholders of District level Local Self-Governments frequently visited the watersheds.

Conclusion and Recommendations

1. The runoff data from the control and Model watersheds clearly established that soil and water conservation measures can definitely store water in situ and reduce run off by half.

2. Proper and annual maintenance of structures, pits, contour trenches etc are necessary for successful performance of any watershed development programme.

3. All watershed development programmes need to establish gauging stations and monitor rainfall and run off for convincing the stakeholders of the importance of soil and water conservation.

Recommendation

In Kerala, where rainfall is high and slopes are steep watersheds need to be developed at the micro watershed level. Appropriate soil and water conservation measures alone can reduce floods during the rainy season and drought in summer.

Cited References

Das, B.L. 1964. Water and watershed management. *Indian Forester*. 90 (8): 495-499.

Holton, H.N. 1969. Hydrologic Research for Watershed Engineering. *J.of Engineering* 8: 207-216.

Holton, H.N. 1969. Hydrologic Research for Watershed Engineering. *J.of Engineering* 8: 207-216.

Sankar S., Thomas P Thomas and KK Unni. 2006. Cost effective soil and water conservation-Establishment of a demonstration area with peoples' participation.KFRI Research Report .31pp

Ullah, W., Gupta, S.K. and Dalal, S.S. 1972. Hydrological measurements for watershed research, Jugal Kishore & Co., Dehra Dun, 299 pp

Appendix

Table 1: Rainfall & Run off during 2006

Sl No	Month	Rainfall (mm)	Total Water Model watershed (m^3)	Run off Model watershed (m^3)	%	Total Water Control watershed (m^3)	Run off Control watershed (m^3)	%
1	June	512	40984	3441	8.4	28688	9180	31.8
2	July	604	48336	2215	4.6	33835	11977	35.4
3	August	499	39948	8165	20.4	27963	12835	45.9
4	September	457	36592	5048	13.8	25614	10373	40.5
5	October	389	31152	0	0	21806	872	4.0
6	November	125	9968	0	0	6977	348	5.0
	Average				7.9			27.1

Table 2: Rainfall & run off during 2007

Sl No	Month	Rainfall (mm)	Total Water Model Watershed (m^3)	Run off Model Watershed (m^3)	%	Total Water Control Watershed (m^3)	Runoff Control Watershed (m^3)	%
1	June	383	30658	3802	12.4	21460	5643	26.3
2	July	1273	101899	28735	28.2	71329	34452	48.3
3	August	690	55232	17287	31.3	38662	14846	38.4
4	September	668	53471	15399	28.8	37429	14971	40.0
5	October	485	39062	6601	16.9	27343	3609	13.2
6	November	90	7204	0	0	5042	0	0
	Average				**19.6**			**27.6**

Table 3: Rainfall & run off during 2008

Sl No	Month	Rainfall (mm)	Total Water Model Watershed (m^3)	Run off Model Watershed (m^3)	%	Total Water Control Watershed (m^3)	Run off Control Watershed (m^3)	%
1	June	585	46800	6178	13.2	32760	9762	29.8
2	July	398	31840	2770	8.7	22288	6708	30.1
3	August	415	33200	6241	18.8	23240	9714	41.8
4	September	381	30480	4693	15.4	21336	5419	25.4
5	October	382	30560	3697	12.1	21392	5647	26.4
6	November	0	0	0	0	0	0	0
	Average				**11.36**			**25.6**

Table 4: Rainfall & run off during 2009

Sl No	Month	Rainfall (mm)	Total Water Model Watershed (m^3)	Run off Model Watershed (m^3)	%	Total Water Control Watershed (m^3)	Run off Control Watershed (m^3)	%
1	June	573	45840	6463	14.1	32088	10300	32.1
2	July	1013	81040	32902	40.6	56728	31937	56.3
3	August	539	43120	7934	18.4	30184	9538	31.6
4	September	400	32000	4480	14.0	22400	5353	23.9
5	October	222	17760	2131	12.0	12432	2038	16.4
6	November	112	8960	537	6.0	6272	527	8.4
	Average				**17.5**			**28.1**