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Watershed Development Scheme for Sustainable Environment and Its Impact - A Case Study

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ABSTRACT

Development of watershed management improve the ground water availability and increases the productivity of the major crops. Srinivasan Services Trust, Cheranmahadevi Taluk, Tirunelveli DT, India was done various watershed management projects in the study area. The crrent study was conducted to understand the various techniques adopted by the organization for the sustainable development, to identify major crops introduced, rainfall pattern, various sources of irrigation, types of soil in the study area, and to know the benefits achieved by the community. The current study gives insights to prevent soil erosion in soil erosion prone zones of rainfed area.

Keywords : Agriculture, Evapo-transpiration, Farm productivity, Green revolution , Rainfall, and Urbanization

I. INTRODUCTION

Due to the simultaneous growth of urbanization and industrialization all over the world, the need of water is of enormous. Watershed management system helps for collecting, conveying, and storing water from rainfall in an area for beneficial use. The beneficial use includes the agricultural purpose; domestic purpose etc. Generally, the storage can be in tanks, reservoirs, underground storage like ground water, and check dams. In India, the rainfall variation is too much. Rainfall may be in the monsoon season starting from June to September. The variation of rainfall is also spatial that in some locations, the rainfall is greater than 200 cm per annum and even in other locations, the rainfall intensity may be of 4000 – 5000 mm. Thus the rainfall intensity is varying from one location to the other location. Therefore, the watershed management system is much essential to utilize the available rain water in an effective way. Water is essential for all life and used in many different ways, It is also a part of the larger ecosystem in which the reproduction of the bio diversity depends. Scarcity of potable water is not limited in many areas and the access of safe water is becoming critical problem day by day. Lack of water is caused by low water storage capacity, low infiltration, larger inter annual and annual fluctuations of precipitation (due to monsoonal rains) and high evaporation demand [1]. Urbanization increases impervious area which directly affects the water cycle. Groundwater table depletion and increased flood peak are typical consequences from the distorted water cycle [2]. Water is critical for rain fed areas, not because of scarcity, but lack of proper management that accelerate shortages [3]. Agriculture has, arguably, been very successful at capturing the major share of the world's exploitable water resources. However, the environmental and socio-economic rationale for this capture by the sector is now being questioned. Unintegrated watershed management system might be lead to high soil erosion rate. Such practice has resulted in an increased of the number of critical watershed and critical land area [4]. Erosion is the removal of soil particles from a site due to the forces of water, wind, and ice. Over time, these forces will slowly wear away or disintegrate the soil. Basically, erosion can be classified into two major types: (i) geological erosion, and (ii) man-made erosion. Geological erosion, which includes soil-forming as well as soil-removing, has contributed to the formation of soils and their distribution on the surface of the earth [5]. The watershed development activities generate significant positive externalities which have a bearing on improving agricultural production, productivity, and

socioeconomic status of the people who directly or indirectly depend on the watershed for their livelihoods. The environmental indicators include water level in the wells, changes in irrigated area, duration of water availability, water table of wells, surface water storage capacity, differences in number of wells, number of wells recharged/defunct, differences in irrigation intensity and Watershed Eco Index (WEI)[6]. Water productivity needs to be enhanced considerably, and therefore, the development of watershed is the most reliable solution for augmenting ground water level to attain self – sufficiency in public distribution of water. Copious amount of water could be yielded through the development of watersheds.

A. Description of Study Area

Cheranmahadevi is a taluk in Tirunelveli District of Tamil Nadu State, India. It is located 15 KM towards west from District headquarters Tirunelveli. Tamilnadu, India. Its Latitude is 8.609 and Longitude is 77.582. It is elevated 61 m above Sea level. The average summer temperature of 37^0C and humidity of 94^0C were recorded. Also the wind from WNW at 7 KPH was recorded recently in the study area.

B. Objectives of Watershed Development Scheme

A watershed is a logical, natural planning unit for sustainable agricultural research and development particularly when environmental considerations are emphasized. Watershed management means the process of creating and implementing plans, programs and projects to sustain and enhance watershed functions that affect the plant, animal and human communities within a watershed boundary [9]. Hydro logically, watershed could be defined as an area from which the runoff drains through a particular point in the drainage system [10]. Watershed projects are more efficient and effective when users are given a role in managing their own watershed resources [11, 12]. The main objectives of watershed development in this study area to increase the water level in the wells and bore holes [13]; to achieve higher growth rate in the primary sector; for improving 'Farm Productivity' and 'Farmer's Income' through 'Green revolution'; To achieve conserving and developing the natural resources of land and water; To increase water use efficiency in common areas; For preventing land degradation with soil & water conservation; to adopt 'Front end advanced technologies' for recharging the ground water through recharge shaft in the water harvesting structure' and to promote greenery for a better environment [14] in the study area.

II. METHODS AND MATERIAL

2.1 Methodology

The rainfall intensity (mm) for the study area (Table 1) measured using a rain gauge [7] was collected from the organization. The methodology proposed starts with the identification all available soil conservation practices in the study area [8]. The methodology adopted for the present area includes the collection of data.

- By observation with the local people.
- By personal interviews of the local people.
- Through Questionnaires prepared and getting filled them by people [9].
- The major watershed developmental activities done by *Srinivasan Services Trust* in the study area were identified.
- The details about the name of the villages and population in each village were collected from Cheranmadhevi taluk office.
- The field visit was made on each village and a formal interview was carried out with the farmers in each village to identify the types of crops (Table 2) preferred by them.
- The major livestock and Poultry (Table 3) in the study area were identified through field visit.
- The major water resources (Table 4) for the smooth functioning of irrigation system were identified field visit.
- The soil samples were collected from the agricultural fields of every individual village within the study area and the soil types were identified (Table 5).
- The various watershed development activities done by *Srinivasan Services Trust* were identified in the study area.

2.2. Collection of Data from the Study Area

Table -1: Average Rainfall Data in mm

Season	Months	Average Rainfall in mm
Winter	Jan-Feb	72.6
Summer	Mar –	141.9

	May	
SW Monsoon	June-Sep	92.6
NE Monsoon	Oct-Dec	429.8

Table -2: Major Field Crops

Sl.No.	Name of the crops
01	Coconut
02	Paddy
03	Sugar cane
04	Banana
05	Mango
06	Guava
07	Lemon
08	Teak
09	Vegetables

Table-3: Major Livestock and Poultry

Sl. No.	Name of Livestock and Poultry
1	Cattle
2	Buffalo
3	Sheep
4	Goats
5	Pigs
6	Horses and Ponies
7	Donkey

Table-4 Sources of Irrigation

Sl.No.	Sources identified
01	Canals
02	Tanks
03	Open wells
04	Bore holes
05	Pump irrigation
06	Lift irrigation

Table-5 Types of Soil Identified

Item No.	Types identified
01	Deep Red Soil
02	Black Cotton Soil
03	Red Sandy Soil
04	River Alluvium

Figure 1 : Drip Irrigation System introduced at West Uppurani Village

Figure 2 : Deep Red Soil used for Teak Plantation in the study area

III. RESULTS AND DISCUSSION

3.1 Developmental Activities

The various developmental activities implemented by the organization were identified in the study area. 756 farmers were identified and 6 farmers group was formed the organization in the study area. Each group was made with 10 members. With the help of these well organized group of farmers, the major programs like Field bunding work (Table 7), Ploughing work for dry land, Farm work, Renovation of existing check dams, Construction of percolation pond, Sunken pond, Catch water pit, Continuous contour trench, Loose bolder structure, New masonry check dams, Vermi compost, Supply of millets, and Fodder cultivation were carried out systematically. Drip irrigation system shown in "Fig.1" was introduced in the dry areas, especially for teak plantation. The yield of crops with those activities has

tremendously changed as compared to the normal yield (Table 6).

Figure 3: Fodder Cultivation for Live stocks at Pattankadu Village

Table-6 Impact of the watershed developmental activities

Total number of farmers identified	756
Formation of farmer's group	6 at average
Number of members in each group	10
Total cultivable area	1035 Ha
Area getting yield above average yield on each crop	650 Ha
Area getting yield below average yield on each crop	385 Ha
Farmers getting yield above average on each crop	523 no.
Farmers getting yield below average on each crop	233 no.

Table - 7 Number of Field bunding works in different villages

Name of the villages	Number of field bunds introduced
Ulagan Kulam	14
Athiyankulam	27
North Idayankulam	19
Pulavankudiyiruppu	10
Boothathan Kudiyiruppu	13
Odakarai	15
Karisalpatti	13
Govinda Peri	5
West Uppurani	16
Kanganankulam	11
Pattan Kadu	10
Pillai Kulam	13
KaniyalanKudiyirupu	15
Deivanayagaperi	22

3.2. Impact of Watershed Development Scheme in the Study area

About 20 villages were benefitted by the development project in the study area, including Ulagan Kulam, Athiyankulam, North Idayankulam, Sadayappapuram, Pulavan Kudiyiruppu, Boothathan Kudiyiruppu, Odakarai, Karisalpatti, Odakarai, Govinda Peri, West Uppurani, Kanganankulam, Pattan Kadu, Veliyar Kulam, Pudhu Gramam, Antony Nagar, Pillaikulam, Kaniyalan Kudiyiruppu, and Deivanayagaperi. The dry lands after ploughing shown in "Fig.2"was utilized for the cultivation of different crops in the study area. The management of live stocks with fodder cultivation shown in "Fig. 3" in many areas increased the income of many farmers. An adequate amount of water in the open well shown in "Fig. 4" and bore hole was proved as an excellent output due to the developmental activities carried out in the study area. The total number of beneficiaries (Table 8) due to the various watershed developmental activities in the study area shows a positive impact.

Table - 8 Total Number of Beneficiaries

Type of Works	Number of beneficiaries
Field bunding works	203
Ploughing work dry land	116
Farm work	17
Percolation pond	5
Check dam renovation	5
Sunken pond	5
Catch water pit	23
Continuous contour trench	3
Loose bolder structure	10
New masonry check dam	1
Vermi compost	22
Supply of millets	58
Fodder cultivation	13

Figure 4: Water levels in a well at Govinda Peri Village The increase in water level availability in a well has tremendously increased the study area under irrigation.

The increase in number of wells and irrigated area was mainly due to the significant improvement in groundwater level and yield attributed to the water harvesting systems [13]. This has significantly increased the irrigation facility and equipments procured by farmers.

IV. CONCLUSION

It has been reported that 510 Ha of fallow land would be treated as cultivable; fertility loss is almost reduced and saved as much as 3 ton / Ha. of soil and rain water was conserved to a greater amount by introducing the "Field bunding works". Moisture was retained in the dry land with "Ploughing work". Soil fertility loss is much reduced. Out of 192 Bore and Open wells, 52 No of Bore and Open wells (25%), water table level raised 1 to 1.5 meter from the existing level. 6 Sq.km of land will be benefited with ground water seepage. 20, 40,018 gallon of rain water has been harvested, get recharge with ground water table. It was reported that with the help of 'Percolation Ponds" in the study area, 23, 08,521 gallon of rain water has been conserved and with the renovation of existing check dams, 28 Ha. of land has been treated; 1088 cubic mt. of soil loss has been prevented; 114002 gallon of ground water table recharged. 45650 of rainwater has been conserved with 'Catch water pits'. With the introduction of "Continuous contour trench", 30 MT of Top soil has been preserved as well as rainwater conserved from 8 Ha dry land area. Heavy Run-off and Soil erosion were reduced in 15 ha. There are 22 No. of farmers have been benefited with 'Vermi Compost', and thus implementing organic farming. With the supply of Millets, 58 Nos of farmers benefited and 310 ha land enriched with micro nutrients. Food productivity would be increased 25% from the existing productivity level. About 300 No. of families would get the net income of Rs 10000 to 15000 per Ha. through dry land farming. 14 Ha. of "Fallow land area" is converted into cultivable area; by which 13 nos of Farmers benefited.

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VI. REFERENCES

[1] Dr. R. K. Sivanappan, "State of the Art Lecture Rain Water Harvesting, Conservation and management Strategies for Urban and Rural Sectors", National Seminar on Rainwater Harvesting and Water Management, Nagpur, (2006), 11-12.

[2] C.R. Bhaskar and Suribabu. 2014. Estimation of Surface Run-off for Urban Area Using Integrated Remote Sensing and GIS Approach. Jordan Journal of Civil Engineering, 8 (2014) No.1.

[3] P.K. Joshi, V. Pangare, B. Shifaraw, S.P. Wani, J. Bouma, and C. Scott. 2004. A case study of watershed Management for Madgyal Village. International Journal of Agricultural Economics, Volume 59 (2004), No 3.

[4] Gusta Gunawan, Dwita Sutjiningsih, Herr Soeryantono, and W. Sulistioweni. 2013. Soil Erosion Estimation Based On GIS and Remote Sensing for Supporting Integrated Water Resources Conservation Management. International Journal of Technology, 2(2013) 147-156.

[5] Shuza Binzaid and Imran Chowdhury. 2014. Soil Erosion Prevention Sustainable Phytoremediation process using Solar Irrigation and Fertilization System. International Journal of Scientific and

Research Publications, Volume 4, Issue 4, (2014) 1.
[6] K. Palanisami and D. Suresh Kumar. 2006. Impacts of watershed development programmes: Experiences and Evidences from Tamilnadu. Agricultural Economics Research Review Volume: 22 (2009)387 - 396.
[7] Thanappan Subash, "Study on the benefits and impacts of water hyacinth at Pazhayar river basin Kanyakumari District, Tamilnadu, India- A case review", International Journal of Environmental Science and Technology, 2(1)(2016), 69-74.
[8] J. Castano, M.T.G. Muhlenberg, A. Van Tilburg, "A new method of measuring the adaptation of soil conservation practices; theory and applications", Netherland Journal of Agricultural Science, 50 (2002) 95-114.
[9] Jankar, International Journal of Advanced Engineering Research and Studies E-ISSN2249–8974
[10] Budumuru Yoganand and G. Tesfa Gebremedhin, "Participatory Watershed Management for Sustainable Rural Livelihoods in India", (Research Paper) Southern Agricultural Economics Association Annual Meeting, Orlando, Florida, (2006) 5-8.
[11] N. Johnson, H.M. Ravnborg, O.Westerman, and K. Probst. 2001. User participation in watershed management and research. CAPRi, IFPRI, Washington, D.C, 19(2001).
[12] G. Maya, V. Unde, and V. Namdev Talore. 2012. Role of watershed development programme in sustainable development: Nidhal experience from Satara District, Maharashtra. Proceeding of International Conference SWRDM, (2012).
[13] TK Sreedevi, SP Wani, R. Sudi, MS Patel, T. Jayesh, SN Singh and Tushar Shah. 2006. On-site and Off-site Impact of Watershed Development: A Case Study of Rajasamadhiyala, Gujarat, India. Global Theme on Agro ecosystems Report No. 20, International Crops Research Institute for the Semi-Arid Tropics, (2006), pp 48.
[14] J.V.S. Murthy. 1998. Watershed management. New Age International, (1998).