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Watershed Project at Kuntar in Karadka Grama Panchayat, Kasargod

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Abstract

In the spaceship economy it is believed that the supply of resources and sinking capacity of earth is limited. Hence for reducing the entropy for the sustainability of human race proper management of earth, water biomass and natural resources are necessary. In connection with this watershed development involves the regeneration of environment and management, the needs of human community to such a way that their demand matches the resources in the present day situation of decentralized governing in the globalized scenario.

Disclaimer

This working paper has been prepared by Shri. Riju Mathew, Research Assistant, District Planning Office, Kasargod. The facts and figures in the report are based on quick field survey done by the author and do not reflect the views or polices of Kerala State Planning Board. The purpose of this document is to provide a comprehensive overview of the scheme/projects implemented by the Local Self Government during XI Five Year Plan.

1:1 Introduction

Activities of man like deforestation wrong farming techniques, livestock overgrazing and faulty land use lead to the destruction of plants and trees cover exposing the earth to the natural forces like heavy rain, direct sunshine and high velocity winds. These in turn lead to environmental problems such as soil erosion, floods or water scarcity. Agriculture yield is lowered and this results in decline in the income level of the community resulting in poverty and eventually leading to migration of labour from rural to urban areas in search of livelihood.

Watershed development therefore involves the re-generation of environment and management needs of human community in such a way that their demands match the resources viz; land, water and vegetation available within that particular watershed. This equilibrium between need and availability of resources will lead to a better and increased resistance to draught and increased agricultural production of augmenting food supply, fodder, fuel and timber. The standard of living improves leading to reduction in poverty induced migration.

Kasaragod district, the land of God, is situated in the northern most part of Kerala. The District Head Quarters and its suburban affected by water shortage and ground water depletion. Kasaragod block is treated as the over exploited in the case of ground water use.

Karadka grama panchayat is a part of erstwhile Kasaragod Block and faced acute shortage of drinking water. For reducing the environmental degradation, NABARD sanctioned a watershed in Kuntar at Adoor village in Karadka grama panchayat and implemented during the period from 2008-09 to 2010-11 with a sanctioned amount of ₹ 7,70,200 in 2008-09, ₹ 5,35,400 in 2009-10 and ₹ 2,36,9710 in 2010-11 for Natural Resource Management (NRM) work.

1:2 Objectives of Study

1. To analyze the extent of fulfillment of the expectations at the beginning of the project.
2. Analyze the effectiveness of watershed project to enhance the ground water table, moisture content and prevention of soil erosion.
3. Analyze the impact of project on socio-economic upliftment.

1:3 Hypothesis

1. The project improves the socio-economic conditions of the stake holders.
2. The project enhances the water table (by sample study of 11 ponds).

1:4 Watershed Defined

The term watershed is coined from a two word 'water' and 'shed'. By the word 'shed' here we mean 'to divide' or to 'separate'. Watershed came to be used to denote a 'divide line' or 'ridge line' which separates a drainage basin from another.

Watershed is a geographical area wherein rainwater falling in drain in to a common point. It is a geo-hydraulic unit or piece of land that drains at a common point. A watershed is defined as the area of land where all of the water that is under it or drains off of it goes into the same place. Water flows downhill, so mountains and ridge tops define watershed boundaries. Size & shape, topography, soil/soil characteristics, precipitation and land use are the factors determining the watershed behavior.

1:5 Relevance of Watershed Management in Kerala

Since soil and water are basic resources that can directly influence the development, the idea of soil and water resources development on watershed basis has gained importance. An important feature of sustainable development is development without causing any damage to the resource base. Watersheds are the ideal units for sustainable development.

The state of Kerala is endowed with a combination of distinct altitudinal variations resulting from the rise of the land mass from 5 meters below sea level in the west to the soaring heights of 2695 meters in the east within the short span of 120 kilometer. The small expanse of land with an area of 38,863 km^2 has a base length of 560 kilometer along the coast and width ranging from 11 kilometer to 124 kilometer.

Physiographically, Kerala terrain has three natural regions namely, lowlands, midlands and highlands. Geologically, Kerala is occupied by four major rock formations namely, crystalline rocks of Precambrian age, sedimentary rocks of Tertiary confined to Neogene period, laterites capping the crystalline and sedimentary rocks and recent and sub recent sediments forming the low-lying areas and river valleys.

The undulating topography, vibrant climate and vivacious hydrology in the background of ever active tectonics resulted in 44 river basins, 1750 sub basins and 4452 mini watersheds providing multitude of lively micro ecosystems. The environment of these micro watersheds are conducive to varying crop types, such as, coconut and rice in the sultry lowlands, rice, tapioca, banana, arecanut, coconut, pepper, cashew and rubber in hot humid midlands and tea, coffee and cardamom in the cool sub tropic highlands. The micro ecosystems are such that the valleys with near waterlogged conditions for most part of the year are seen juxtaposed with dry hilltops decked with densely canopied trees.

1:6 Rivers in Kerala

The State is drained by 44 rivers, of which 3 are east flowing. Rivers are generally swift flowing having very steep gradients in their higher reaches. Absence of delta formation is characteristic of rivers in Kerala. The general drainage pattern of these rivers is dendritic, although at places trellis, sub-parallel and radial occur. The segments of river courses are nearly straight, indicating structural control, coinciding with the prominent lineament directions (NW-SE and NE-SW).

1:7 Soil

Ten broad groups of soils based on morphological features and physico-chemical properties have been identified in Kerala. They are red soil, laterite soil, coastal alluvial soil, riverine alluvial soil, grayish onattukara soil, brown hydromorphic soil, hydromorphic saline soil, acid saline soil, black soil and forest soil. 122 major soils series and 66 associations identified in the broad soil groups, most predominant being the laterite soil.

Texturally, in the lowlands, sandy soil dominates in the beaches and dunes and clayey soils in the runnels. Estuaries and backwaters have loamy and clayey soils with high salt concentrations. Soils of the midland, which are lateritic in nature, are predominantly clayey or gravelly clayey. Generally, the soils are acidic in reaction with low cation exchange capacity and base saturation. Organic carbon content is low in the lower elevations and high in the mid and higher elevations. Soils in the high ranges north of Palghat gap, excluding the Nilgiris, are clayey to loamy in texture with high amount of organic matter. Soils of the Palghat gap are neutral to alkaline. In the Nilgiris, the high hills have loamy, clayey and gravelly clay soils, predominantly with low base saturation and fairly high Cation Exchange Capacity (CEC). The medium hills have loamy and clayey soils.

1:8 Land Use

Kerala has a diverse land use and cropping pattern. The land reforms introduced in the state brought in radical and comprehensive institutional changes leading to drastic

transformation in the land holding pattern. This has resulted in shift in the land use pattern. Agriculture is the dominant land use type of the state. It accounts for over 55 per cent of the geographical area followed by forest land (including degraded forest) of 28 per cent but area under non-agricultural use is only 11 per cent (Farm Guide, 2006).

1:9 Environmental Issues

The increased pressure on land due to demand for more resources to satisfy the need and greed of mankind caused the upward spread of cultivation into steeper areas better left under forest. There are human interventions in the form of mining, quarrying, filling of water bodies, etc leading to significant land modification. This would influence the biophysical system and adversely affect the ecological security and environmental stability. There are also issues of seismicity, landslides, floods, etc which has a bearing on the environmental quality. Continued industrialization and urbanization exert further pressure on the land, increasing the level of degradation and pollution and decreasing the ecological diversity of land environment.

1:10 Soil Erosion

The erosion status of the state reveals that 83,500 ha is severely eroded, 973,245 ha is moderately eroded, 1064,879 ha is moderate to slightly eroded, 307,708 ha is slightly eroded and 620,965 ha is under permanent vegetation and is well protected. It is estimated that on an average annually about 15-18 tons/ha of soil is eroded from areas where adequate conservation practices are not adopted. A rough estimate of soil erosion and sedimentation for India reveals that about 5300 million tones of top soil are eroded annually and 24 per cent of this quantity is carried by rivers as sediments and deposited in the sea, and nearly 10 per cent is deposited in reservoirs reducing their storage capacity by 2 per cent (Department of Land Resources, MoRD, GOI).

1:11 Meteorological Parameters of Kasargod District

Temperature

The temperature is more during the months of March to May and is less during December and January. The average monthly maximum temperature ranges from 29.2^0C to 33.4^0C and minimum temperature ranges from 19.7^0 C to 25^0C.

Relative Humidity

Relative humidity is more during morning hours and is less during evening hours. During the morning hours it ranges from 87.1 to 98.7 per centand during evening hours it ranges from 54.4 to 86.5 per cent.

Evaporation

Evaporation is more during summer months of March to May. In general it ranges from 2.2 to 6.3 mm/day. During south-west monsoon season, it ranges from 2.2 to 3.7 mm/day.

Sunshine Hours

Sunshine ranges from 3.2 to 10.2 hours/day. Maximum sunshine is during the month of February. The months of June to August record the minimum sunshine due to the cloudy sky. Generally good sunshine hours are recorded in the months of November to May.

Wind

The wind speed ranges from 2.1 to 3.3 km/hour. The wind speed is high during the months of March to June and less from September to December.

1:12 Geographical features

Physiographically the district can be divided into three district units viz. the coastal plains, the midlands and the eastern highland regions. The coastal plains with an elevation of less than 10

m occur as narrow belt of alluvial deposits parallel to the coast. To the east of coastal belt is the midland region with altitude ranging from 10 m to 300 m average mean sea level (amsl). The midland area is characterized by rugged topography formed by small hillocks separated by deep cut valleys. The midland regions show a general slope towards the western coast and to its east is the high land region. The midland and hill ranges of the district present a rugged and rolling topography with hills and valleys. Along the midlands the hills are mostly laterite and the valley are covered by valley fill deposits. The valley fill deposits are composed of colluvium and alluvium

1:13 Ground Water Scenario

Ground water occur under water table conditions in alluvium, laterites and weathered mantle of the crystallines, where as in the deeper fractured crystalline the groundwater occurs under semi confined to confined conditions. Since the physiographic set up and geological formations are same for all the blocks, (the block area starts from the coast and ends on hilly areas and are parallel in east west direction) the hydrogeological conditions are same in each block. The only difference is the percentage of alluvium area. Alluvium occurs as narrow strips parallel to the coast and the width increases from the northern part of Kanhangad block to southern part of Nileshwar block and around Trikaripur of Nileshwar block. In Kasargod and Manjeshwar blocks alluvium occur as isolated patches close to the coast and have limited thickness.

1:14 Ground Water Resources

The following is a ground water assessment done block-wise by government as per GEC-1997 methodology as on March 2004.

Table-1
Net Annual Ground Water Availability

Sl No	Name of Blocks	Net Annual Groundwater Availability (mcm)
1	Manjeshwaram	92.00
2	Kasaragod	63.85
3	Kanhangad	94.64
4	Nileshwaram	93.05
Total		**343.54**

Table-2
Categorization of Block for Ground Water Development

Sl No	Name of Blocks	Stage of Ground Water Development	Is there a Significant Decline of Pre-Monsoon Water Table Levels (Yes/No)	Is there a Significant Decline of Post-Monsoon Water Table Levels (Yes/No)	Categorization for Future Groundwater Development (Safe/Semi critical/Critical/Over -exploited)
1	Manjeshwar	70.65	Yes	Yes	Semi critical
2	Kasargod	123.59	Yes	Yes	Over exploited
3	Kanhangad	72.79	Yes	Yes	Semi critical
4	Nileshwar	63.23	Yes	No	Safe

2:1 Brief history of the Project at Kuntar

As a commitment to the agricultural and economic improvement of Kasaragod district, which is declared as a distressed district by Government of India, NABARD has come forward with

support for watershed based developmental intervention in the district. In 2008, as per the report of the District Soil Survey Department, Kasaragod and willingness letter from Karadka grama panchayat by appointing Centre for Research and Development (CRD), Nilesharam as the Project Facilitating Agency (PFA) for the Project, NABARD has selected Kuntar Watershed for scientific treatment.

Kuntar is a village area at Karadka grama panchayat in Karadka block panchayat of Kasaragod district. Experts/Officials from NABARD along with the GP representatives, PFA and farmers have visited the watershed on 29 February 2008. Total area of the Watershed is 594 ha and the CBP area is 98 ha.

2:2 A Brief Report on Capacity Building Phase (CBP) Project Implementation

The Capacity Building Phase (CBP) Project is being implemented with active participation of the Watershed Community. The Village Watershed Committee (VWC) is taking lead role in the implementation of various components with the technical support from PFA. PFA has appointed Watershed Development Team (WDT) exclusively for facilitating the watershed activities. For an effective co-ordination, an office of VWC is installed with in the watershed. This office is being used for convening VWC meeting, WDT meeting and keeping of all Accounts, Reports and MIS formats.

2:3 Qualifying Shramadhan

4 days Shramadhan by every land owned family is mandatory in NABARD watersheds. The Kuntar watershed community had undertaken works like Live Fencing, Water Percolation Pit and Agroforestry activities for qualifying shramadhan. All these works are meant for soil and water conservation. Both male and female have participated actively in qualifying shramadhan. 145 families have participated in the shramadhan.

2:4 Financial Details as per Sanction Letter

Table-3
Financial Details

Sl. No	**Item**	**Amount in ₹**
A	Physical Treatment cost	
1	NABARD Grant amount for physical treatment	750805.00
2	NABARD Grant amount for supervision cost	66509.00
3	Shramadhan for Physical treatment	133017.00
	Sub total	***950331.00***
B	Management cost(Grant amount)	142550.00
C	Pre-CBP expense (Grant amount)	15000.00
Total project cost(A+B+C)		**1107881.00**
Total Grant amount(1+2 of A+B+C)		***974864.00***
Total Shramadhan(3 of A)		***133017.00***

Table-4
CBP Project Measures Implemented

Sl No	Activity/Item of Expenditure	Units of Measures	Total unit Sanctioned in the Project	Total Amount Sanctioned	Cumulative Progress			
					Physical	%	Financial	%
1	Water Percolation Pit(WPP)	cum	2406	154910	2406	100	154910	100
2	Contour Trenches(CT)	cum	6525	105070	6525	100	105070	100
3	CentriPetal Terrace(CPT)	cum	1598	55710	1598	100	55710	100
4	Live Fencing(LF)	Rm	4700	102910	4700	100	102910	100
5	Agro Forestry(AF)	No	4811	105350	4811	100	105350	100
6	Agrostological Measures(AM)	Rm	2350	6680	2350	100	6680	100
7	Earthen Bund (EB)	cum	5015	80760	5015	100	80760	100
8	Collection Pit (Farm pond)	cum	11	8260	11	100	8260	100
9	Brush Wood Check Dams(BCD)	No	7	3380	7	100	3380	100
10	Loose Boulder Check Dams(LCD)	No	25	46480	25	100	46480	100
11	Loose boulder Check Dams(LCD)	No	13	40280	13	100	40280	100
	Sub Total for Treatment	-	-	**709790**	-	**100**	**709790**	**100**
12	Supervision cost	-	-	60410	-	-	60410	100
Total				**770200**	-	**100**	**770200**	**100**

2:5 Location and Extend of Kuntar Watershed

Kuntar watershed at Adhur Village in Karadka grama panchayat is situated about 25 kms from district head quarter in east direction via Cherkala and 3 kms from the grama panchayat head quarter in east direction. The watershed includes parts of wards 6 and 7 of the grama panchayat. The Cherkala – Jalsoor State highway passes through this watershed.

2:6 Types of Soil in Watershed.

Based on different morphological characteristics, soils of the watershed have been classified in to six soil series. Similar soils having same characteristics are grouped as soil series. For grouping soils texture, soil depth, erosion, drainage, slope of land, moisture availability, soil climate, etc which are having definite effect on soil, are studied. The land subjected to filling with soil transported from other areas have been classified as miscellaneous soils. Their names, physiographic occurrence and extent are as under.

Table – 5
Soil Series in Kuntar Watershed

Sl. No.	Soil Series	Occurrence	Area (ha)
1	Arathil	Strongly sloping to very steeply sloping side slopes of low hills	133
2	Kidur	Strongly sloping to very steep side slopes of low hills	216
3	Meeyangan am	Moderately sloping to very steep side slopes	57
4	Kolathur	Gently to moderately sloping flat low hill tops	20
5	Muttathy	Very gently to gently sloping paddy fields	10
6	Perumbale	Gently to moderately sloping midlands	38
7	Miscellaneous soil type	Very gently to moderately sloping made-up lands along stream banks	120
Total			**594**

2:7 Socio-economic Profile

Kuntar watershed has total 401 families and the total population is 2076 (1068 males and 1008 females). Average family size is 5.18. Following table shows population against age group.

Table-6
Population against Age Group

Population	Age Group					
	Less than 5	**5-15**	**15-40**	**40-60**	**60 & above**	**Total**
Males	94	192	421	278	83	1068
Females	89	201	360	249	109	1008
Total	**183**	**393**	**781**	**527**	**192**	**2076**

The population comprises of Hindus and Muslims. Ninety per cent of the families depend on agriculture and allied sector to earn income and about 30 per cent of the families are BPL category. The literacy rate is 82 per cent. There were 30 SC families and 9 ST families in the sample.

Land Holding

About 58.74 per cent of the families have land below 1 acre, 23.35 per cent families have own land between 1-2 acres, 10.63 per cent have own land between 2-4 acres and 7.29 per cent have own land between 4-8 acres. Average gross land holding per household is 1.14 acre.

Major Problems in the watershed (mainly in water, soil and agriculture) are:

Social Problems

There were social problems like houseless families, sanitation issues, health hazards, financial constraints of the families, educational unemployment, lack of family budgeting and financial management practices, extravaganza expenses by the family

members, low status of women in the family and society, unproductive participation of people in the grama sabhas of the grama panchayat, etc.

All the above problems were addressed by developmental agencies with convergence of programmes. Watersheds as it has natural boundaries are the real units for development unlike development based of political boundaries.

2:8 Water Balance Study

Ground Water Recharge by Natural Monsoon

Total Area of Watershed	-	496 ha
Average Annual Rainfall	-	2311 MM
Area of Runoff Zone	-	178 ha
Area of Recharge Zone	-	358 ha
Area of Storage Zone	-	58 ha
Effective Rainfall	-	2079.90 MM
Ground water recharge by Monsoon	-	509.86 ha M

Table-7
Ground Water Recharge by Existing Storage Structures

Sl. No.	Treatment	No of Units	Recharging Capacity	Recharging Frequency	Volume (ha M)
1	Farm Pond (FP)	460	0.38	3	1.14

Total Ground water Recharge = By Monsoon + By Storage Structure
= 510.99 ha M

Runoff Resulting from the Selected Watershed

Annual rainfall	=	2311 MM
Area of watershed	=	594 ha

Table-8
Runoff Resulting from the Selected Watershed

Land use Pattern	Slope (%)	Area (ha)	C Value	Runoff (ha M)
Cultivated Land	0-5	180	0.60	249.59
	6-10	68	0.60	94.30
	11-30	54	0.72	89.86
Wood Land	0-5	46	0.40	45.53
	6-10	24	0.58	32.17
	11-30	18	0.54	22.47
Pasture Land	0-5	58	0.45	60.32
	6-10	32	0.36	26.63
	11-30	16	0.42	15.53
Total				**636.40**

Volume Stored due to Existing Structures - 1.14 ha M

Volume Stored due to proposed treatment - 84.60 ha M

Table-9
Recharge Capacity, Recharge Frequency and Volume Stored

Treatment	No of Units	Recharging Capacity (ha M)	Recharging Frequency	Volume Stored (ha M)
Contour Trench	17450	0.60	60	36.00
Earthen Bund	11124	0.03	60	1.80
Water Collection Pits	122	0.4	12	4.80
Water Percolation Pits	9089	0.6	60	36.00
Ground water recharging system	113	0.04	60	2.40
Stone pitched bund	201	0.06	60	3.60
Total				**84.60**

2:9 Ground Water Withdrawals

Drinking water requirement (2076 persons) - 15.15 ha M

Livestock requirement (846 livestock) - 9.30 ha M

Irrigation Needs

Table-10
Irrigation Needs

No of Wells	Lifting Device	Power (HP)	Average Daily Operating Hours	Operating Days per Year	Discharge (Cum/hr)	Draft (ha M)
85	Electric Motor	5.0	5	180	25	191.25
60	Diesel motor	8 .0	4	110	20	52.80
110	Diesel motor	3.0	7	165	18	228.69
185	Electric motor	1.0	3	140	6	46.62
40	Electric motor	2.0	4	120	12	23.04
Total						**524.4**

Ground Water Withdrawal = Domestic purpose + Irrigation needs + Evaporation loss
= 565.614 ha M
Present Total Ground Water = 510.99 ha M
Water balance = (-) 54.624 ha M
Hence there is a shortage of water during summer season.
Runoff volume = 636.40 ha M
Volume stored due to existing structures = 1.14 ha M
Volume stored due to proposed treatment measures =84.60 ha M
Total ground water availability after treatment measures
=595.59 ha M
Balance runoff = 551.8 ha M

After the successful implementation of the watershed project there will be excess ground water in the Kuntar watershed.

2:10 Objectives:

Following were the objectives of the project

Overall Objective

"Sustainable development of Kuntar watershed"

Specific Objectives

1. To conserve the resource base in Kuntar watershed
2. Promote water conservation measures
3. To augment the ground water table
4. To Improve the soil health
5. To improve production and productivity of agriculture crops
6. To improve the living standard of the people

2:11 Project Results

We expect following results out of the implementation of the measures

Sl No	Results	Indicator/criteria	Means of verification
1	Soil health improvement/ improved water absorption capacity of soil	The water absorption capacity of soil & the soil nutrients content	Soil test/analysis, crop productivity details
2	Improvements in production and productivity of crop	Total quantity of production from each crop per year and the production per ha	Records kept by the farmers and MIS system

3	Maintaining sustainability of agriculture through gaining more income	Number of farmers continuing agriculture as a main source of income & number of new farmers and the new area under cultivation	Village records and MIS system
4	Sedimentation rate reduced	Reduced occurrence of flood & over flow in streams	Village records and direct observation tool
5	Run-off velocity of water in the streams reduced	Reduced occurrence of flood & over flow in streams and non occurrence of damage to streams/stream banks	Village records and direct observation tool
6	Ground water augmentation and availability of water round the year for irrigation, drinking and other livelihood activities	Water table of the water bodies, length of availability of water from water bodies	Well inventory and direct observation& focus group discussion tools
7	Increase in biomass	The fertility of soil	Soil test/analysis, crop productivity details
8	Increase in biodiversity	Vegetation status	MIS and mapping

9	Increase in credit intake of farmers and its productive use	Quantum of credit and its use by farmers	Bank records& Pass books of farmers
10	Improvements in income generated (incremental income) from crops and livelihood opportunities	Income level & purchasing capacity of the families	Family records
11	Leadership development & improved leadership capacity	New leaderships emerged and the leadership capacity of people	VWC Minutes, MIS , New programmes taken up by the VWC , etc

2:12 Analysis of the effects of NRM work on water tables of ponds

For this purpose, 11 ponds tested at the month of May 2008 and May 2012, the results are given below.

Table-11
Water Table of 11 Ponds during 2008 and 2012

Water table of pond in May 2008 (in mtrs)	Water table of pond in May 2012 (in mtrs)	d	d^2
0.55	1.05	-.50	.25
1.00	1.65	-.65	.4225
2.45	3.2	-.75	.5625
0.3	0.95	-.65	.4225
0.25	0.9	-.65	.4225
0.55	0.9	-.35	.1225
1.00	1.25	-.25	.0625
0.20	0.65	-.45	.2025
0.60	0.85	-.25	.0625
0.85	1.25	-.4	.1600
0.50	0.95	-.45	.2025
		-5.35	**2.8925**

H_o: the NRM work will not increase the water table of ponds.
H_1: NRM work will increase the water table of ponds.
At 5% level of significance, the test statistic (t) is -9.4589

Table value of 5% level of significance at degrees of freedom 10, the table value of t is 2.228.

The test statistic is numerically higher than the table value we reject the null hypothesis at a 95% confidence level. That is the NRM work in Kuntar watershed increase the water table.

2:13 Findings

1. The watershed project increases the general welfare of the people in watershed area.
2. It decreases the soil erosion rate.
3. It enhances the environmental awareness among the people.
4. By using t- test it found that the NRM work is effective on enhancing the water table in ponds

2:14 Suggestions

1. It is better to implement more watershed projects in Kasaragod district to enhance the water table and ground water level.
2. For preserve the resource trinity, govt. should conduct awareness programme in villages.
3. More forest based watershed projects is needed in Karadka block.

2:15 Conclusion

For the sustainable development a check to the greed to the natural resource trinity is essential. The voluntary preservation of natural resources can be done through the management of watershed project. People can view directly the benefits of environmental quality through the preservation of the resource trinity and can anticipate a prosperous future.