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Research Article

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A Case Study of Watershed Management for Rafiabad-B Watershed

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ABSTRACT

Rafiabad-B is a small Watershed located at distance of 24 Kms from Baramulla district. It lies between 34◦13'N latitude and 74◦23'E longitude with mean elevation of 1581 meters. It consists of three micro-watersheds namely Seripora (Brm-1-1), Markoot (Brm-1-2), Chanam(Brm-1-4). The present study was undertaken for estimating the availability and condition of resources and their respective use over a period of time. As very limited information about natural resources, their condition and utilization was available, therefore the present study was undertaken for estimating the status and condition of natural resources and changes in it over the period of time i.e., from 1991 to 2000. Some measures have been adopted to recharge the ground water resources and prevent soil erosion. Hence it is planned to take such engineering and biological measures which will direct this extra runoff to ground water storage. Geographic information system (GIS) an essential tool for watershed planning and management tasks. For the GIS mapping drainage network, topography, geology maps, flow path of water are to be easily locate. Efforts are made to divert large amount of rainwater to recharge ground water resources.

Key words: *Engineering measures, Watershed management techniques, ground water storage, soil erosion Geographic information System*

INTRODUCTION

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. In agricultural areas, draining of fields causes water to run off the land and into streams and lakes more quickly, bringing sediment, nutrients, and other pollutants along with it. This can lead to flooding and water quality problems. To reduce soil erosion, planning, conservation and management of the watershed is vital[11]. Watershed management is not so much about managing natural resources, but about managing human activity as it affects these resources. Water demand already exceeds water availability in many parts of the world and as the world population continues to rise, so does the water demand[3].

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The drainage area of the river provides the natural boundary for managing and mitigating human and environmental interactions. Because human activity includes actions by government, municipalities, industries, and land owners, watershed management must be a cooperative effort. Effective watershed management can prevent community water shortages, poor water quality, flooding and erosion. The expense of undertaking watershed management is far less than the cost of future remediation. For development of agriculture and drinking water resource the basic elements required are land and water. Because of tremendous rise in population, urbanization, industrialization and agriculture area, resulting in steep incline water demand line. Indian agriculture sector is lot more depend upon the monsoon. But last 3-4 years due to inadequate rainfall, people are looking towards the underground water as alternative source without regarding to its recharge resulting in deepening of ground water table 100-200m below the ground surface. Remote sensing data provides accurate timely and real time information on various aspects such as size and shape of the watershed, land use/land cover, physiography, soil distribution, drainage characteristics etc[11,12].

Drought of Jammu and Kashmir

The State of Jammu and Kashmir was lacking in good roads till the great famine of 1877-79. It was only after that famine that the necessity of roads and proper transport network was realized by the Govt. In the study area only one crop i.e. rice is raised in the summer due to severe winters no crop could be raised resulting thereby in a famine in the area with the failure of kharif harvest alone. This is not only the reason for drought in the area but excessive rains in the harvesting season of rice are the major reason. The altitude of this watershed is very high hence most of the villages are dependent over the rains in the area for the cultivation of rice. Due to inadequate Villages like Hamam, Dazne, Markoot, Chatoosa and Chanam are hit by Drought and Famine quite often.

MATERIAL AND METHODS

The methodology adopted for the present area includes the collection of data.

According to the objectives of the study a total of 3 micro-watersheds covering 12 villages in total were randomly selected from the total study area on the basis of drainage map (Made from satellite images) of the area. The data regarding different environmental factors were collected from different departments like IWMP, PHE department, Soil conservation department and formed our secondary sources of data. Primary data was collected by questioning and interviewing local people in the study area. The data was then analyzed and presented in the form of charts and diagrams. Finally different conclusions were drawn and some efficient management techniques were put forward for consideration and implementation for efficient use and management of land and water resources in the study area.

STUDY AREA

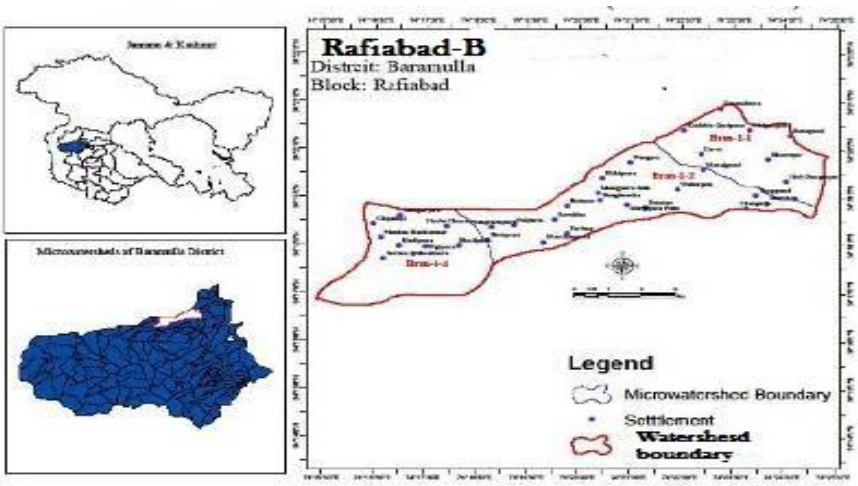

Fig. 1:

AN OVERVIEW OF RAFIABAD OF BARAMULLA

Rafiabad is located 24 kms away from the District Baramulla. The IWMP Rafiabad (B) project 2011-12 is the IST project under IWMP in district Baramulla. It was started in the month of September 2012. The total area of project is 4306ha out of which 4162ha is proposed area to be treated and the estimated cost of the project is 624.30 lacs consists of three micro-watersheds namely Seripora (Brm-1-1), Markoot (Brm-1-2), Chanam(Brm-1-4). These three micro watersheds consist of three Gram panchayts namely Chanam, Chatoosa, and Fidarpora. These three Gram panchayts comprises six Panchayat halqas covering twelve villages, having 970 total households. The project area is also having a high percentage of General population followed by Scheduled Tribes & very less percentage of Schedule castes. Almost all the area included in this project falls under hilly terrain with steep slopes. Upper belts are covered with forests. Which remain covered with snow till May. The climatic conditions in the area ranges from hot summer to harsh winter. The snowfall occurs mainly during the months of December, January and February. Which almost affect the livelihood activities of the people & make survival difficult? This area is blessed with natural beauties .Some of areas like Munddagi, Hamam are famous for picnic spots which remains crowded during summer. The natural streams running in the area also is important part of its beauty. The most important streams are Hamal Nallah, Viji Nallah and its distributaries feed almost all irrigated area of the project. The Hamal Nallah is almost 30-35 kms long from Markoot (top of the project) to Fidarpora (outlet of the project) which is main source of irrigation & also utilized for domestic purpose. During summer large number of trout fishes is found in Hamal Nallah which is caught by local population. A small trout fishery unit is established by fisheries Department in one of the village of project area but a lot of things could be done to promote trout culture in this area which could be a source of livelihood for the local people. Agriculture and horticulture is the chief source of livelihood. The majority of crops grown in this area are paddy followed by maize and pulses. Apple and walnut are the main horticulture crops of this area followed by pear, peach, and plum. The vegetative cover in forests and pastures has suffered degradation due to mismanagement and human invasion which caused soil erosion. The land holding capacity of farmers is small and the farm mechanization is very poor. Irrigation and drainage is also a major concern for the population. The terracing along with soil conservations activities and irrigation drainage structures are the main priority of this area. Most of the people have livestock like cows, sheep, goat and poultry. Local variety of cow gives an average of four liters of milk per day while as cross breed cows yield almost ten liters of milk per day. Majority of the people are engaged with agricultural & horticultural practices. Major occupation of the people is labour & few people are engaged with other services. Majority of the population is illiterate. The road connectivity is very poor and transport facility is very scare. Some villages of the project area do not have roads because of which the local population has to travel 3-4 kms on foot to reach nearby bus stop & during winters it become even more difficult for them. The local population is highly hospitable & cooperative, which is a special feature of Kashmiris.

Table No.1 Micro-Watershed with Geographical Area

Sl. No	Micro-Watershed Code	Geographical Area(Ha)
1	Seripora (Brm 1-1)	1817
2	Markoot (Brm1-2)	1036
3	Chanam (Brm1-4)	1291

AGRO- GEO CLIMATIC CONDITIONS OF THE STUDY AREA

Rafiabad-B has a humid subtropical climate much cooler than what is found in much of the rest of J&K, due to its moderately high elevation and being in northern position. The area is surrounded by the Himalayan Mountains on all sides. Winters are cool, with daytime a January average of 2.5 °C (36.5 °F), and temperatures below freezing at night. Moderate to heavy snowfall occurs in winter and the only road that connects Rafiabad-B with the rest of the state may get blocked for a few days due to avalanches. Summers are warm with a July daytime average of 24.1 °C (75.4 °F). The average annual rainfall is around 710 millimeters (28 in). Spring is the wet season while autumn is the driest.

Crop Calendar

Table No. 2. Crop Calendar

Crop	Sowing	Harvesting	Marketing Peak Lean
1	2	3	4
Rice	April – May	September – October	November
Maize	April – May	September – October	November
Mustards	October – November	October- November	May June
Oats	October – November	April – May	May June

Source: IWMP Baramulla

LAND USE PATTERN

Table No. 3 Land use pattern

S. No	Village	Geographical Area#	Forest Area	Community Land	Land under Non Agriculture Use	Permanent Pastures	Uncultivated Private land		Cultivated area		Net Sown Area	Net Area sown more than once	Gross Cropped Area
							Temporary fallow	Permanent Fallow	Cultivated Rain fed	Cultivated Irrigated			
1	Seripora	838.08	253	5		98	110	78	258	258	258	230	258
2	Budan	473.76	129	433		23	19	12	250	250	250	225	250
3	Fidarpora	700.32	236	1.68		78	58	100	213	213	213	200	213
4	Machanpora	447	115	17		58	25	22	210	210	210	195	210
5	Markoot	553.44	198	10		69	25	14	189	189	189	175	189
6	Hamam	610	220	4		75	28	26	253	253	253	220	253
7	Dazne	450	99	27		42	45	49	178	178	178	165	178
8	Chatoosa	681.72	146	46		19	42	78	350	350	350	300	350
9	Chanam	2092	872	182		101	95	121	721	721	721	700	721

BASELINE DETAILS OF THE STUDY AREA

Table No. 4 POPULATION

SL. No.	Feature	Male	Female	Total
1	Population			
	SC	0	0	0
	ST	0	0	0
	OBC	444	25	469
	GEN	504	27	531
	Total	948	52	1000
2	Total Children (0-14 Years)	2	0	2
	School Going Children (0-14 Years)	0	0	0
3	Sex Ratio			54.85232
4	Literacy	42%	2%	40%
	Literates	395	1	396
	Illiterates	553	51	604
5	Work Force			
	Govt. Job	122	2	124
	Pvt. Job	3	0	3
	Self Emp	805	5	810
	Un-Emp	15	44	59
	House Work	0	1	1

SOURCE: CENSUS 2011

Economic Status (Based on Income):

Table No. 5

SL. No	Category of Farmers	Total HH	No. of BPL HHs	SC	ST	OBC	GEN	Village Average
1	Marginal	331	183	0	0	101190.9	95609.76	49200.15
2	Small	166	75	0	0	116820.3	111614.5	57108.7
3	Big	541	235	0	0	159779.7	132473.5	73063.3
4	Landless	762	54	0	0	106507.4	137166.7	60918.52
	Total	1800	547	0	0	484298.3	476864.4	240290.7

Poverty Analysis:

Table No. 6

Sl.NO	Name of the Patch	No. of HHs			
		Total	AAY	BPL	APL
1	Seripora Agri	4	0	0	4
2	Fidarpora Horti	77	2	37	38
3	Fidarpora Agri	95	8	91	210
4	Budan Horti	48	0	46	2
5	Machanpora Agri	50	0	95	13
6	Machanpora Horti	85	8	90	75

Drinking water Status:

Table No. 7

Sl.No.	Source	No. of Families benefiting from Active source	No. of Families getting water - "Good Quality"	No. of Families getting water - "Satisfactory Quality"	No. of Families getting water - "Unsatisfactory Quality"	No. of Farmers benefiting throughout the Year	No. of farmers benefiting Seasonally
1	Well	0	0	0	0	0	0
2	Village Pond	0	0	0	0	0	0
3	Canal/Kuhl	0	0	0	0	0	0
4	Lift Irrigation	0	0	0	0	0	0
5	Tap Water	1144	0	1144	0	1143	1
6	Water Tanker	0	0	0	0	0	0
7	Overhead Tank	0	0	0	0	0	0
8	WH Tank	0	0	0	0	0	0
9	Other	0	0	0	0	0	0

LAND AND WATER RESOURCES

Table No. 8

Sl.No	Type of the Land	No of HHs having such land	No. of BPL HHs having such land	Irrigated (Kanal)	Un-Irrigated (Kanal)	Fallow (Kanal)	Waste Land (Kanal)	Horticulture (Kanal)	Total Land (Kanal)
1	Assigned Land	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	Own Land	1038	493.00	2937.90	887.00	12.00	1141.75	8302.50	13281.15
	Total Land	1038	493.00	2937.90	887.00	12.00	1141.75	8302.50	13281.15

Sources of Irrigation

Table No. 9

Sl.No.	Source	No. of Farmers benefiting from "Active source"	No. of Farmers benefiting from "Partially Active source"	No. of Farmers suffering from "Inactive Source"	No. of Farmers those can be benefited "if activated"	No. of Farmers benefiting "throughout the Year"	No. of farmers benefiting "Seasonally"
1	Bore Well	0	0	0	0	0	0
2	Dug Well	0	0	0	0	0	0
3	Canal/Kuhl	101	995	0	1096	1073	23
4	Lift Irri	0	0	0	0	0	0
5	Dam	0	0	0	0	0	0
6	Lake	0	0	0	0	0	0
7	WH Tank	0	0	0	0	0	0
8	Spring	0	0	0	0	0	0
9	Other	0	0	0	0	0	0

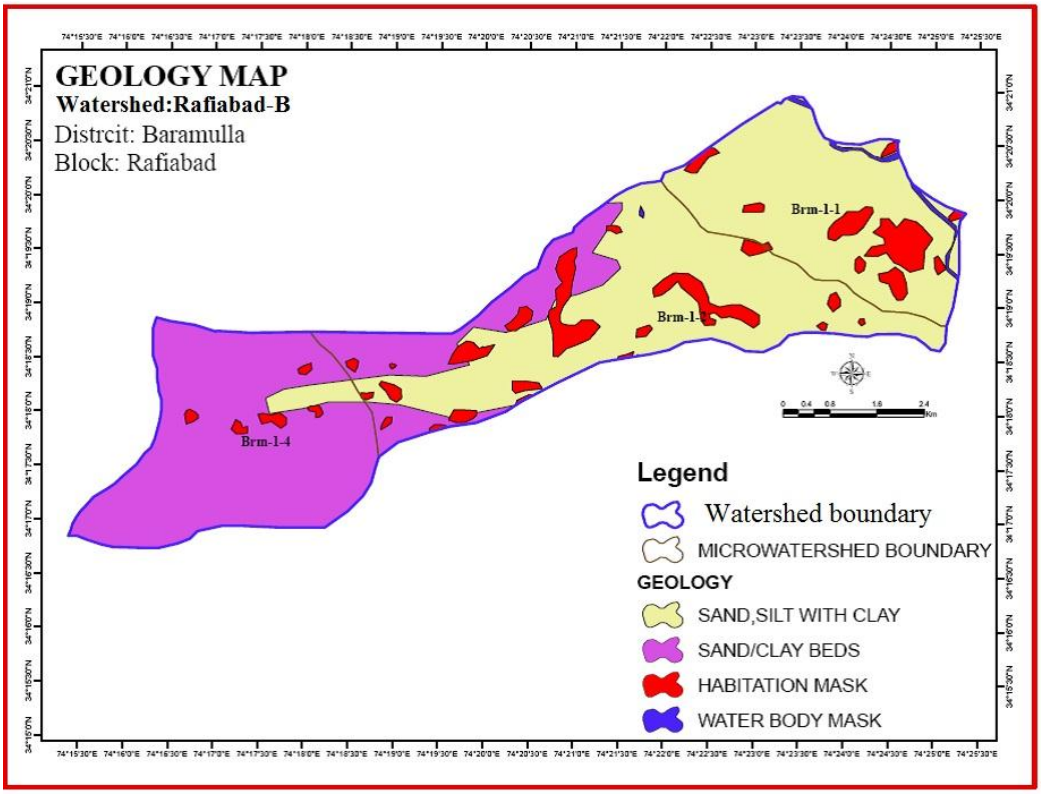

Figure (2) Geology Map

GROUND WATER TABLE

Table No. 10

s.no	Micro-watershed	Village	Source	Groundwater Depth
1	Seripora (Brm 1-1)	Fidarpora	Dug well	13
		Machanpora	Bore well	11
		Seripora	Bore well	16
		Burden	Dug well	10
2	Markoot (Brm 1-2)	Markoot	Bore well	17
		Hamam	Dug well	16
		Dazne	Bore well	16
		Chatoosa	Dug well	12
3	Chanam (Brm 1-4)	Chanam	Bore well	11
		Sangrampora	Dug well	13
		Chepdajji	Dug well	17
		Takiya Chanam	Bore well	17

CONCLUSION

Therefore, these soils require immediate attention for their conservation and rehabilitation. In the total study area 7611.3 ha i.e., 81.4 percent of agricultural land is un-irrigated or rain fed, resulting in limited or reduced production and under exploitation of land resources. Moreover, the water situation in the study area was also pathetic as on the one hand nearly 60-70 percent of the total annual precipitation in the study area is lost as run-off whereas on the other hand many areas have no water for irrigation or drinking purposes. To fulfill this demand watershed management technique need to be implemented. Socio- economic survey shows that more than 76% of people having agricultural land. Living standard of people is poor. If watershed development project implemented then it will result in increase the living standard and economic condition of people in Rafiabad village. Runoff is very

important factor. It is easy to make rise in water table, due to check to the flow of water or runoff. Runoff occurs in nallas/streams. Due to GIS software it is possible to find out stream lines on which the structures are to be planned, slope direction, topography, hills is very important factor is useful for analysis and decision making in the watershed area. Demand will be fulfill. For successful implementation of this project participation of local people, government officers, and funding agencies is must. As these techniques are eco-friendly, the development due to this in future will be sustainable

PLANNING AND MANAGEMENT OF LAND AND WATER RESOURCES

From the comparison of land use/land cover pattern of the study area during two different periods i.e. year 1991 & 2000, it was quite concerning that such drastic changes in the area under forest lands had taken place. Also the area under agriculture and scrub lands had also increased which in very undesirable as the study area falls in Baramulla district of J&K which already has more than 17 percent of its total geographical areas under waste lands (as reported by NRSA Hyderabad). Moreover, the Carrying Capacity of the study area was far below than their actual requirement of resources produced by natural resources in the study area, putting immense pressure on the natural resources leading to their overexploitation and degradation. The seriousness of this problem can be judged from this fact that the total study area of 24753.2 ha has approximately 20792.7 ha of land i.e., nearly 84 percent area under different soil erosion intensity classes (III, IV and V). These soils had poor nutrient availability and production potential, making them more liable to soil erosion and degradation. Therefore, these soils require immediate attention for their conservation and rehabilitation. In the total study area 7611.3 ha i.e., 81.4 percent of agricultural land is unirrigated or rain fed, resulting in limited or reduced production and under exploitation of land resources. Moreover, the water situation in the study area was also pathetic as on the one hand nearly 60-70 percent of the total annual precipitation in the study area is lost as run-off whereas on the other hand many areas have no water for irrigation or drinking purposes. Therefore, the immense pressure in these resources can be somehow eased by effective management of these resources with stake holder's co-operation and participation. An Integrated Wasteland Development Project for Rafiabad-B Watershed (Baramulla district) was formulated by J&K Forest Department during the year 1990 and was started as a centrally sponsored scheme with the help of NWDB, in 1992.

The Rafiabad-B Watershed Development Project was executed in 30 micro watersheds drawn from 24589 ha of Rafiabad-B Watershed, Baramulla district with financial implication of 229.50 lakh for:

A. Conservation of ecologically fragile area of 3300 ha.

B. Regeneration and development of degraded forests in this degraded area. The Watershed Project implemented in this area was of very small scale i.e. covering only 3300 ha (out of 27453.0 ha of total watershed area) for a period of five years only i.e. 1992-1997. But this Micro-Watershed Development improved the existing management situation of natural resources in the study area and provided many tangible and in-tangible benefits. The measure of intangible benefits from this project was beyond the scope of this study therefore, only tangible benefits that followed due to effective management are given below:-

A. Conservation of Ecologically fragile area. Nearly 1300 hectares of ecologically fragile area was treated during the Project tenure, Out of this area 500 ha of land was afforested for fuel wood & fodder 400 hectares of land was used for pasture development, 200 hectares of land was planted with various agro-forestry horticultural tree and rest of 200 ha is planted with shrubs, grasses and legumes to conserve moisture and to control erosion B. Regeneration and development of degraded forests

For regeneration and development of degraded forests nearly 2000 ha of land requiring immediate attention was taken up. Natural and artificial regeneration was practiced in 1000 ha and 500 ha respectively nearly 500 ha of land was planted with shrubs, grasses and legumes for providing land cover to degraded lands.

Watershed management:

Watershed is an ideal unit calling for multidisciplinary approach to the resources management for insuring continuous benefits on sustainable basis. Watershed management implies the proper use of all land and water resources for optimum production with minimum hazard to natural resources. Nowadays watershed management is becoming a blue print for agricultural development in most parts of the country. Watershed management Programme aims at conserving soil and moisture, as well as putting the lands to use according to their capabilities and hence improving the overall productivity of the catchments. The success of planning for development activities depends on the quality and quantity of information available on both natural and socio economic resources. Therefore accurate and reliable data base generation and management are extremely important for devising the ways for optimal planning and management of watersheds.

Water harvesting techniques:

The various system of water harvesting depends upon source of water supply are classified as below:

- In- situ Rain Water harvesting
- Bunding and terracing
- Vegetative contour barriers
- Land leveling
- Contour ditching
- Contour farming
- Mulching
- Conservation tillage and deep ploughing
- Rainwater /Direct surface runoff harvesting
- Roof water harvesting
- Dugout pond
- Diversion bunds
- Water spreading
- Stream flow or runoff harvesting
- Nallah bunding
- Gully control structures / check dams / Bandharas
- Water harvesting dam/ stop dam
- Percolation tank
- Sub Surface flow harvesting
- Sub Surface dams / barriers
- Sub Surface Bandharas
- Diaphragm dams
- Micro catchment/ watershed
- Inter – terrace / inter plot water harvesting
- Conservation bench terracing
- Micro watershed / micro plot
- Runoff inducement by surface treatment
- Metaled catchment by surface treatment
- Using chemical for water proofing

REFERENCES

1. Kulkarni, S. S. and Swami, V. A., "Watershed Management Sustainable Development" - A Case Study *Journal of Engineering Science and Technology* 3 March Pp. 2105-2112 (2011).
2. Krishna, R., Roshan, T., Bajracharya, M. and Bishal, K., Sitaula "Natural Resource and Watershed Management in South Asia: A Comparative Evaluation with Special References to Nepal" *Agriculture And Environment* **9:** Jun. Pp. 7289 (2008).
3. Umar, Sheikh & Khan, Junaid & Malik, Mohd & Manzoor, Saika & Mushtaq, Jasir. Prediction of Runoff in Dachigam Catchment and Generation of Time Series Autoregressive Model. Current Journal of Applied Science and Technology. 27. 1-12. 10.9734/CJAST/2018/38694 (2018).
4. Yoganand, B. and Tesfa, G., Gebremedhin "Participatory Watershed Management for *Sustainable Rural Livelihoods in India*", (2006).
5. Agnihotri, Y., "Environmental Conservation Resulting From Social Changes as an Effect of *Watershed*

Management Programme" In Sustainable Development Pp-226-230. VPH Banglore

6. Lata, A. S., & Samra, J. S., "Determinants of People's Participation in watershed Development and Management: An Explanatory Study in *Shivalik Foothill Villages in Haryana*" In Sustainable Development Pp-231-244. Vph Banglore.
7. Sharda, V. N., ''Integrated Watershed Management: Managing Valleys and Hills in the Himalayas'' *International Water Management Institute*, South Regional Office, New Delhi/Patancheru, India, Pp. 61-81 (2005).
8. Wani, S. P. and Ramakrishna, Y. S., ''Sustainable Management of Rainwater through Integrated Watershed Approach for Improved Rural Livelihoods' *International Water Management Institute*, South Asia Regional Office, New Delhi/Patancheru, India, Pp. 39-60 (2005).
9. Sanjeeva, R. P. L. and Rao, K. P., Watershed Development Programmes in India: Experience, Issues and Future Agenda. *Journal of Rural Development*. **18(3):** (1999).
10. Tejwani, K. G., Gupta, S. K. and Mathur, H. N., *Soil and Water Conservation Research. ICAR*, New Delhi (1975).
11. Malik, Mohd & Pandit, Bashir & Umar, Sheikh & Manzoor, Saika. Marphometric Analysis and Prioritization of Micro Watersheds of Chandanwari Watershed of lidder Catchment Using Geospatial Techniques. *Current Journal of Applied Science and Technology*. 25. 1-12. 10.9734/CJAST/2017/38589 (2017).
12. Umar, Sheikh & Manzoor, Saika & Malik, Mohd. Morphometric Analysis and Prioritization of Purinabal Watershed of Sindh Catchment for Soil and Water Resource Management Using Geo-Spatial Tool. *International Journal of Recent Scientific Research*. 10.24327/ijrsr. 2017.0810.1101 (2017).